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1957 ANNUAL

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he radio amateurs' journal · November

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BIG AND CLEAN SSB SIGNALS

There is pride in the ownership of a strong signal and every courteous amateur is equally proud of a clean signal — a signal that a neighboring amateur friend can work close to.

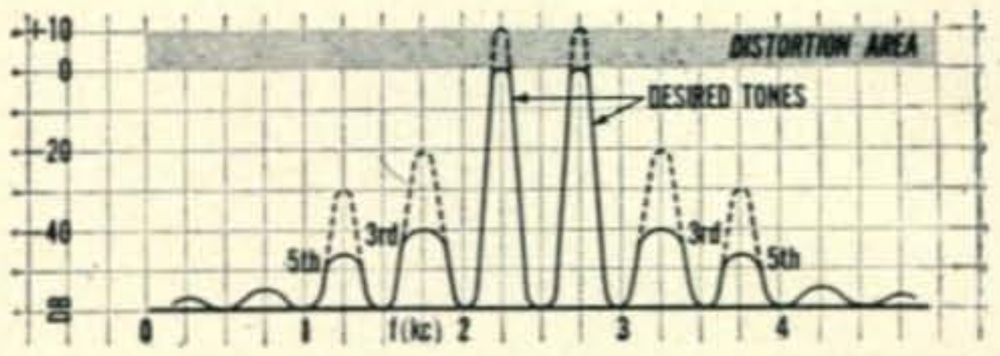
Three kc is enough spectrum space for good SSB voice communication and more just annoys or robs a friend of a contact near your frequency. The Collins filter system, using a Collins Mechanical Filter with steep skirts on both sides, strictly limits the band width. Uses only the amount of spectrum space absolutely necessary.

Once a clean and narrow SSB signal is generated, it must be converted to the desired carrier frequency and raised to the desired power level. Properly designed low level amplifiers and mixers have low distortion, but in the driver and final power amplifier the amount of distortion generated is of concern. Rather severe distortion may not degrade the quality of your signal to the fellow you are working but another amateur near you on the band knows it.

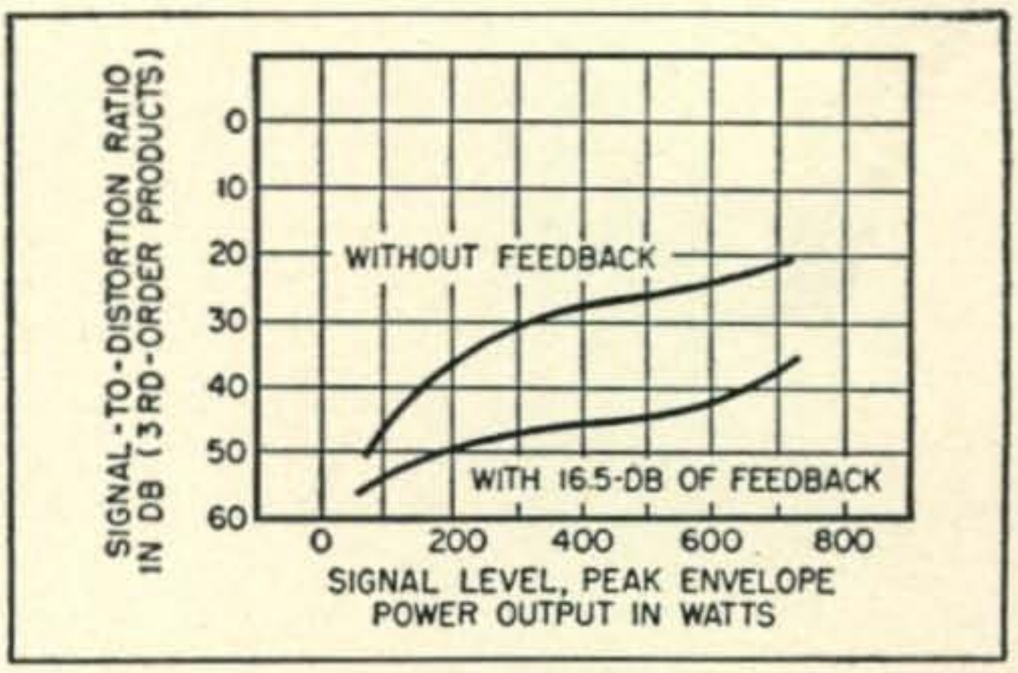
Most PA tubes can be operated with acceptably low distortion, but this is far below their maximum power capabilities. Some compromise between power output and distortion must be made in tube operation. But Collins engineering makes it possible to have your cake and eat it too.

Collins uses RF feedback — an exclusive feature of the KWS-1 and KWM-1 — to get maximum tube output and efficiency and still keep a clean signal. The energy in the distortion products is less than one-tenth with feedback than it otherwise would be.

Any linear amplifier will distort badly when heavily overdriven. Collins equipment uses automatic load control to keep speech peaks within the capabilities of the amplifier and to keep the average level high.



The ALC maintains the signal peaks just within the non-distortion level.



With RF feedback, distortion products are reduced and allow a more efficient amplifier.

It feels good to own a big and a clean SSB signal — the kind the Collins KWS-1 and KWM-1 put out. Collins KWS and KWM are the only amateur transmitters with these features.

Warren B. Bruene

W. B. Bruene – WØTTK
Collins Communication Engineering Division Technical Consultant

For further information, check number 21 on page 206.

Collins CREATIVE LEADER IN COMMUNICATION COLLINS

There's a PR for every Service!

AMATEUR

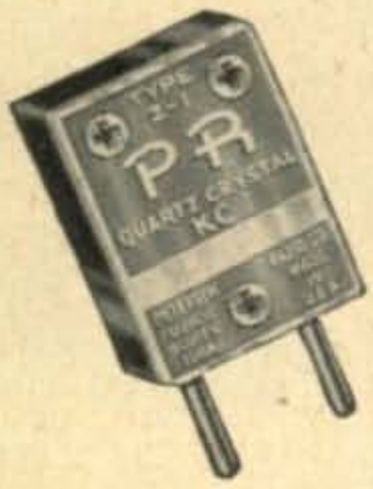
40, 80 and 160 Meters, PR Type Z-2

Rugged. Low drift, fundamental oscillators. High activity and power output. Stands up under maximum crystal currents. Stable, long-lasting, permanently sealed.....**$2.95 Net**

20 Meters, PR Type Z-3

Harmonic oscillator. Low drift. High activity. Can be keyed in most circuits. Stable as fundamental oscillators. Fine for doubling to 10 and 11 meters or "straight through" 20 meter operation.....**$3.95 Net**

COMMERCIAL



COMMERCIAL, PR Type Z-1

Designed for rigors of all types of commercial service. Calibrated .005 per cent of specified frequency. Weight less than ¾ ounce. Sealed against moisture and contamination. Meets FCC requirements for all types of service.

SPECIAL TYPES

Type Z-1, AIRCRAFT

3023.5 Kc., .005%.....**$3.45 Net**

Type Z-1, MARS and CAP

Official assigned transmitter frequencies in the range.
Calibrated to .005%. 1500 to 10000 Kc. **$3.45 Net**

Type Z-6A
FREQUENCY STANDARD

To determine band-edge. To keep the VFO and receiver properly calibrated.

100 Kc. . . . . **$6.95 Net**

PR PRINTED OSCILLATOR KIT

Has many uses—

- As 100 Kc. Marker
- As 1000 Kc. Marker for Check Points up to 54 Mc.
- As Foundation Circuit for Low Frequency SSB Crystals

Assembled in minutes. Kit contains everything but 6BA6 oscillator tube and crystal.

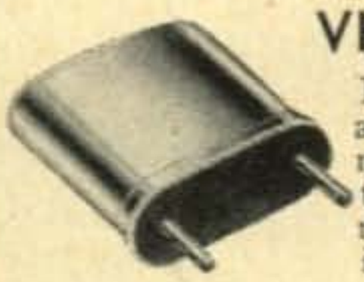
Each . . . . . **$4.50 Net**

Type 2XP

Suitable for converters, experimental, etc. Same holder dimensions as Type Z-2.

1600 to 12000 Kc. (Fund.) ±5 Kc. . . . **$3.45 Net**

12001 to 25000 Kc. (3d Mode) ±10 Kc. . . . **$4.45 Net**



VHF Type Z-9R

For Lear, Narco and similar equipment operating in the 121 Mc. region, requiring crystals in 30 Mc. range.

Each . . . . . **$4.95 Net**

Type Z-9A RADIO CONTROLLED OBJECTS

27.255 Mc., .04% . . . **$3.95 Net**

Type Z-1
TV Marker Crystals

Channels 2 through 13 . . . . . **$6.45 Net**
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5.0 Mc. Sig. Generator, .01% **2.95 Net**
10.7 Mc. FM, IF, .01% . . . **2.95 Net**

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Whew! What a job getting this first Annual issue of CQ ready for you. I sure hope you like it. You'll note that the regular columns are on vacation for a month to make more room for articles. And I've done everything I can to make sure that all of the articles are interesting. If you read 'em you'll find that they are all excellent. By the time the advertising got through gobbling up space I only had room for 45 feature articles, but this is several times as many as any radio magazine has ever had before, so I'm not complaining. Lessee now, at $1.00 that would be 2.22c per article, or $1.00 for the article that flips you and the rest for free. A bargain? Unless you're subscribed, as you should be, and the whole issue only cost you about 30c, which would make it a ridiculous bargain.

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New York 36, New York

Authors would do well to send for the CQ Style sheet which will explain our confused system of abbreviations and symbols. The article "Author Author" (October 1952 CQ) tells all about how to write articles for CQ, how much we pay, etc. Reprints of this article are available from CQ if you have been improvident in keeping up your radio library.

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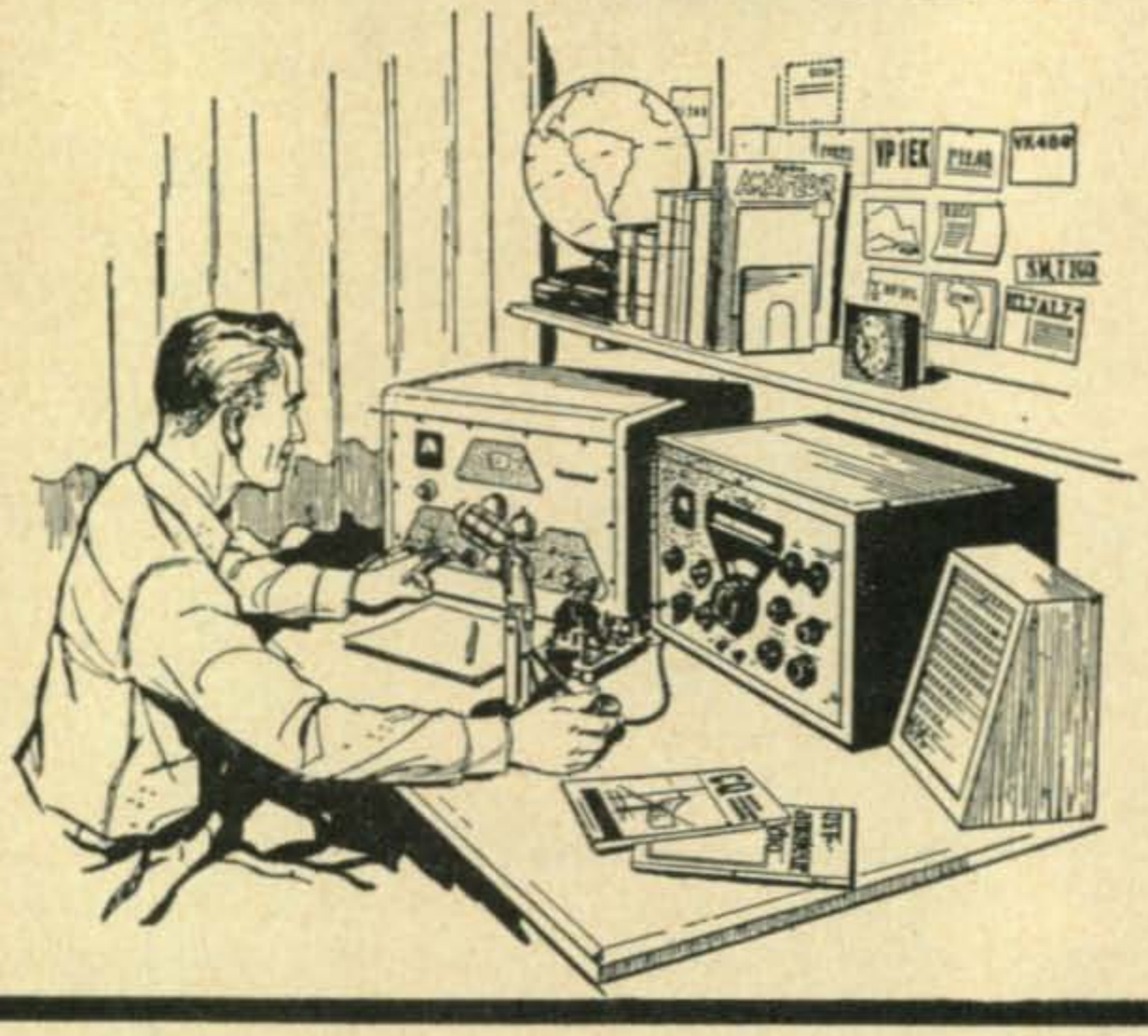

The world's finest ham equipment in kit form . . . designed especially to meet your requirements!

Heath amateur radio gear is designed *by* hams—*for* hams, to insure maximum "on the air" enjoyment. Good design and top-quality components guarantee reliability. Heathkits are easy to build and are easy on your budget! You save by dealing direct, and you may use the Heath Time Payment Plan on orders totaling $90.00 or more. Write for complete details.

HEATHKIT

DX-100

TRANSMITTER KIT

PHONE AND CW

- *Phone or CW—160 through 10 meters.*
- *100 watts RF on phone—120 watts CW —parallel 6146 final.*
- *Built-in VFO—pi network output circuit.*
- *Easy to build—TVI suppressed*

MODEL DX-100

$189.50

$18.95 dwn., $15.92 mo.

Shpg. Wt. 107 Lbs.

Shipped motor freight unless otherwise specified. $50.00 deposit required on c.o.d. orders.

The Heathkit DX-100 phone-CW transmitter offers features far beyond those normally received at this price level. It has a built-in VFO, built-in modulator, and built-in power supplies. It is TVI suppressed, and uses pi network interstage coupling and output coupling. Matches antenna impedances from approximately 50 to 600 ohms. Provides a clean strong signal on either phone or CW, with RF output in excess of 100 watts on phone, and 120 watts on CW. Completely bandswitching from 160 through 10 meters. A pair of 1625 tubes are used in push-pull for the modulator, and the final consists of a pair of 6146 tubes in parallel. VFO dial and meter face are illuminated. High-quality components throughout! The DX-100 is very easy to build, even for a beginner, and is a proven, trouble-free rig that will insure many hours of enjoyment in your ham shack.

HEATH COMPANY BENTON HARBOR 12, MICHIGAN

A Subsidiary of Daystrom, Inc.

For further information, check number 2 on page 206.

HEATHKIT DX-35
TRANSMITTER KIT

PHONE AND CW

This transmitter features a 6146 final amplifier to provide 65 watt plate power input on CW, with controlled-carrier modulation peaks up to 50 watts on phone. Modulater and power supplies are built in, and the rig covers 80, 40, 20, 15, 11 and 10 meters with a single band-change switch. Pi network output coupling provides for matching various antenna impedances. Employs 12BY7 oscillator, 12BY7 buffer and 6146 final. Speech amplifier is a 12AX7, and a 12AU7 is employed as modulater. Panel control provides switch selection of three different crystals, reached through access door at rear. Panel meter indicates final grid current or final plate current. A perfect low-power transmitter both for the novice or the more experienced amateur. A remarkable power package for the price. The price includes tubes, and all other parts necessary for construction. Comprehensive instruction manual insures successful assembly.

MODEL DX-35

$56.95

Shpg. Wt. 24 Lbs.

$5.70 dwn., $4.78 mo.

- *Phone or CW—80 through 10 meters.*
- *65 watts CW—50 watts peak on phone—6146 final amplifier.*
- *Pi network output to match various antenna impedances.*
- *Tremendous dollar value—easy to build.*

BRAND NEW

HEATHKIT DX-20
CW TRANSMITTER KIT

MODEL DX-20

$35.95

$3.60 dwn., $3.02 mo.

Shpg. Wt. 18 Lbs.

- *Designed exclusively for CW work.*
- *50 watts plate power input—80 through 10 meters.*
- *Pi network output circuit to match various antenna impedances.*
- *Attractive and functional styling—easy to build.*

Here is a straight-CW transmitter that is one of the most efficient rigs available today. It is ideal for the novice, and even for the advanced-class CW operator. This 50 watt transmitter employs a 6DQ6A final amplifier, a 6CL6 oscillator, a 5U4GB rectifier and features one-knob bandswitching to cover 80, 40, 20, 15, 11 and 10 meters. It is designed for crystal excitation, but may be excited by an external VFO. A pi network output circuit is employed to match antenna impedances between 50 and 1000 ohms. Employs top-quality parts throughout, including "potted" transformers, etc. If you appreciate a good signal on the CW bands, this is the transmitter for you!

HEATH COMPANY BENTON HARBOR 12, MICHIGAN

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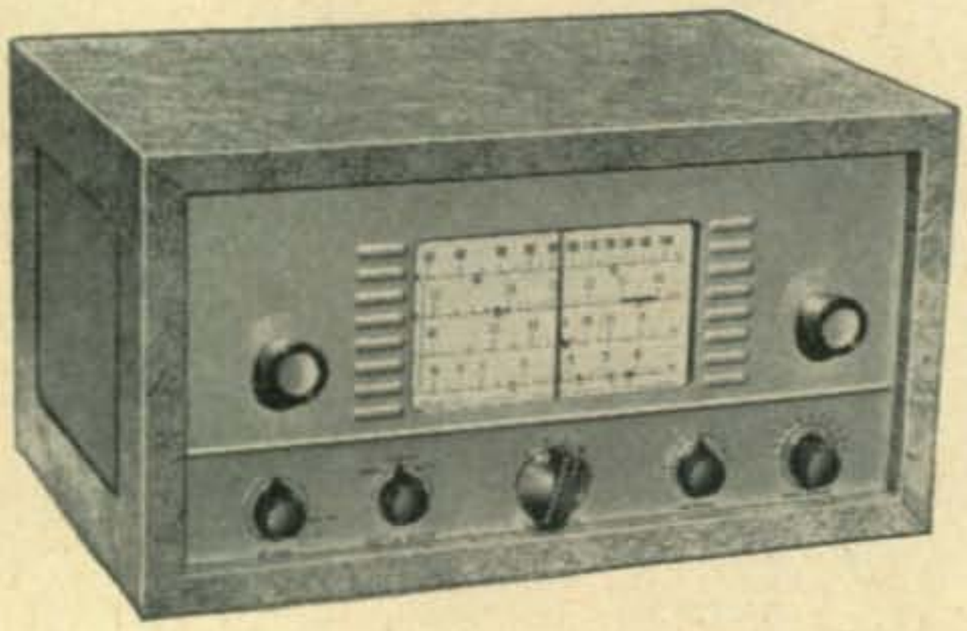
For further information, check number 8 on page 206.

HEATHKIT

COMMUNICATIONS-TYPE, ALL BAND

RECEIVER KIT



This receiver covers 550 kc to 30 mc in four bands, and is ideal for the short wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with fine image rejection. Amateur bands are clearly marked on the illuminated dial scale. Features transformer-type power supply—electrical band spread—antenna trimmer—separate RF and AF gain controls—noise limiter—headphone jack—and AGC. Has built-in BFO for CW reception. Shpg. Wt. 12 Lbs.

CABINET: Fabric covered cabinet with aluminum panel as shown. Part 91-15A. Shipping Wt. 5 Lbs. $.50 dwn., $.42 mo. $4.95

MODEL AR-3

$29.95

incl. excise tax (less cabinet)

$3.00 dwn., $2.52 mo.

Ⓐ HEATHKIT VFO KIT MODEL VF-1

Covers 160, 80, 40, 20, 15, 11 and 10 meters with three basic oscillator frequencies. Better than 10 volt average RF output on fundamentals. Requires 250 VDC at 15 to 20 ma, and 6.3 VAC at 0.45A. Incorporates regulator tube for stability and illuminated frequency dial. Shpg. wt. 7 lbs. $1.95 dwn., $1.64 mo. **$19.50**

Ⓑ HEATHKIT GRID DIP METER KIT MODEL GD-1B

Continuous coverage from 2 mc to 250 mc with prewound coils. 500 ua panel meter for indication. Use to locate parasitics, for neutralizing, determining resonant frequencies, etc. Will double as absorption-type wavemeter. Shpg. wt. 4 lbs. $2.00 dwn., $1.68 mo. **$19.95**

Ⓒ HEATHKIT ANTENNA IMPEDANCE METER KIT MODEL AM-1

The AM-1 covers 0 to 600 ohms for RF tests. Functions up to 150 mc. Used in conjunction with a signal source, will determine antenna resistance and resonance, match transmission lines for minimum SWR, determine input impedance, etc. Shpg. wt. 2 lbs. $1.45 dwn., $1.22 mo. **$14.50**

Ⓓ HEATHKIT "Q" MULTIPLIER KIT MODEL QF-1

Functions with any receiver having IF frequency between 450 and 460 kc that is not AC DC type. Operates from receiver power supply, requiring only 6.3 volts AC at 300 ma (or 12.6 vac at 150 ma), and 150 to 250 vdc at 2 ma. Simple to connect with cable and plugs supplied. Provides extra selectivity for separating signals, or will reject one signal to eliminate heterodyne. Effective Q of approximately 4000. Shpg. wt. 3 lbs. $1.00 dwn., $.84 mo. **$9.95**

HOW TO ORDER...

It's simple—just identify the kit you desire by its model number and send your order to the address listed below. Or, if you would rather budget your purchase, send for details of the Heath Time Payment Plan for orders totaling $90.00 or more.

HEATH COMPANY BENTON HARBOR 12, MICHIGAN

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For further information, check number 4 on page 286.

EDITORIAL . . .
WAYNE GREEN

. . . de W2NSD

NEVER SAY DIE

Nice Guy

Look fellows, I try to be a nice guy, but I'm all trapped in my environment just the same as you are. Whenever I ask someone how come he doesn't put up a better antenna, build a better transmitter, or like that, I get the same answer: "Gee, I don't have time." It's the same with me. I have, for a group of psychological reasons which I defy anyone to fathom, settled into an unusual pattern of living. It is pretty hectic overall and as you might expect very little gets done thoroughly.

Take the mail for example. For the most part I get it within a day or two after it is delivered to the CQ office. Then I read it over and at the first opportunity answer the simpler and more pressing items. The others either get answered while I am working over a bunch of weeks old letters trying to catch up or else finally get filed with the hope that the fellow really didn't expect an answer.

Where does all the time go? Well, I've sort of stayed clear of my private life. For one thing I have been accused too many times of talking about myself and have gotten oversensitive about it. For another, in our society it is supposed to be a good thing to be modest. So why should I go into print and make 85,000 readers hate me.

Tell you what. All youse guys what are sitting around waiting to write and tell me what a no good bum I am may now turn the page and find less provocative subject matter. Even if I am as stupid, dumb, idiotic, dopey, etc., as you say I am, I don't like to read about it. To me I am just a guy sitting at a typewriter in a cluttered room in Brooklyn. On every side are frustrations . . . things which need attention. My life is surrounded by hobbies, any one of which could easily take my full time. My major hobby is, and has been for over twenty years now, Ham radio.

The rest of my time is spent with things like horseback riding (I'm tempted to show you a picture of my horse), water skiing (in the summer, skin diving, dating (I'm still single, gals), flying (small seaplane), boating, mountain climbing, speilunking (rare), hamfest and conventioning, traveling (mainly to places with good skin diving), reading, listening to hi-fi, showing color slides, plus the *more prosaic pursuits* such as movies, TV and work. Work? Well, if you call editing a magazine devoted to your major hobby work, then I work. It's a lot of fun most of the time and a gosh awful grind the rest of the time . . . like the two days I had to spend on the Save Eleven Contest results.

Just putting out the magazine is quite a job, but fortunately I have an able assistant who takes care of the dirty work. I'm kept busy reading the submitted manuscripts, answering letters, taking care of the Editorial, Letters to the Editor Column, QSL Contest, Puzzler, New Products, Subscription Ads, Table of Contents, Hamfests, and CQ Tested items. Plus an unlimited number of special projects like handbooks, hot news items that have to be chased down, new FCC legislation, certificates, and even visits to some of our advertisers. The number of things that come up in a week would amaze you. I lay out ads, I take photos for our cover (September) and even for the advertisers at times. I consult with manufacturers on new products . . . even to the extent on occasion of doing some of the engineering that he should have done in the first place. This is not a complaint, I just wanted you to get the picture. I like my life this way.

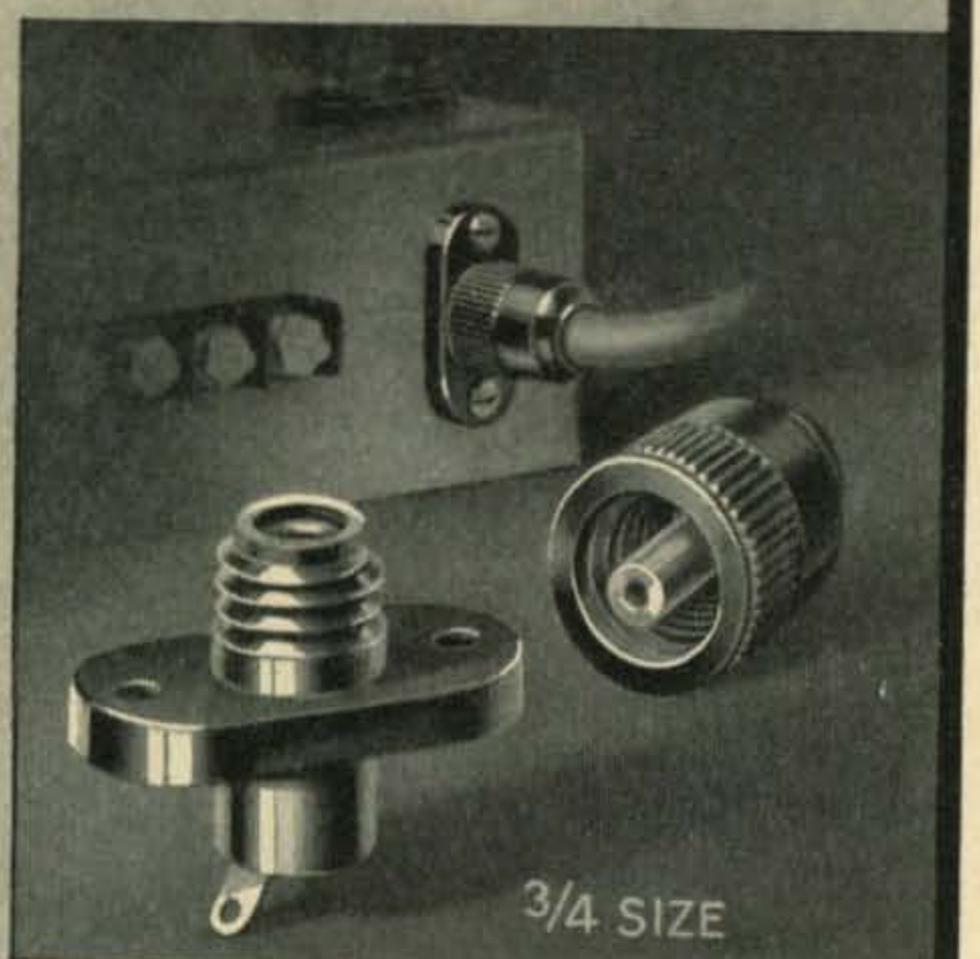
The next time you find yourself in disagreement with me I'd appreciate it if you would let me know, but try not to be insulting about it. An editor should have a thick skin and be insensitive to complaints for it is absolutely impossible to please everyone. *I'm* sensitive. What'll I do, take pills? Be sparing with the praise too, for I tend to get puffed up and more difficult to push around when flattered. And I, like everyone else, believe implicitly anything good you tell me about myself. The complaints have been few, usually running to one or two highly insulting letters, and one well-taken point per month, thank Heavens.

ARRL

Now, while I'm still running on truth serum, I'd like to try to straighten things out about CQ and ARRL. If you will look back through the last three years' issues of CQ you will find very little that could be construed as being anti-ARRL. It was my policy when I took over as editor of CQ to stop all that sort of thing. To the best of my knowledge this has not cut any ice with the Head-

Designed for

Application



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quarters Gang for I have still had to suffer the indignity of being invited to speak at ARRL Conventions only to be told at the last minute that orders from the Top are that I am not to speak. This was particularly frustrating and infuriating at the San Francisco Convention last year after I had flown all the way out there just for that purpose.

The San Antonio Convention this July broke the ice. I don't know how they managed it (I heard that there was quite a battle), but I turned out to be one of the main speakers and held forth for over an hour before almost the entire convention. I want to thank all of the fellows who took the time to seek me out later and compliment me on the talk. I particularly enjoy getting such an opportunity for there are quite a few things that I have to say that I really can't write here in CQ.

But I didn't get invited to the National Convention this year. This turned out to be fortunate, in a way, since I managed to be up on Mt. Washington at the right time to make news instead. Bigger news than the convention, as far as the papers were concerned, hi!

My attitude is this: sure, I disagree with the ARRL on many things, but it is the *only* radio club we've got so why tear it down. Maybe I ought to run for Director, eh? Relax, Hartford, I'm kidding.

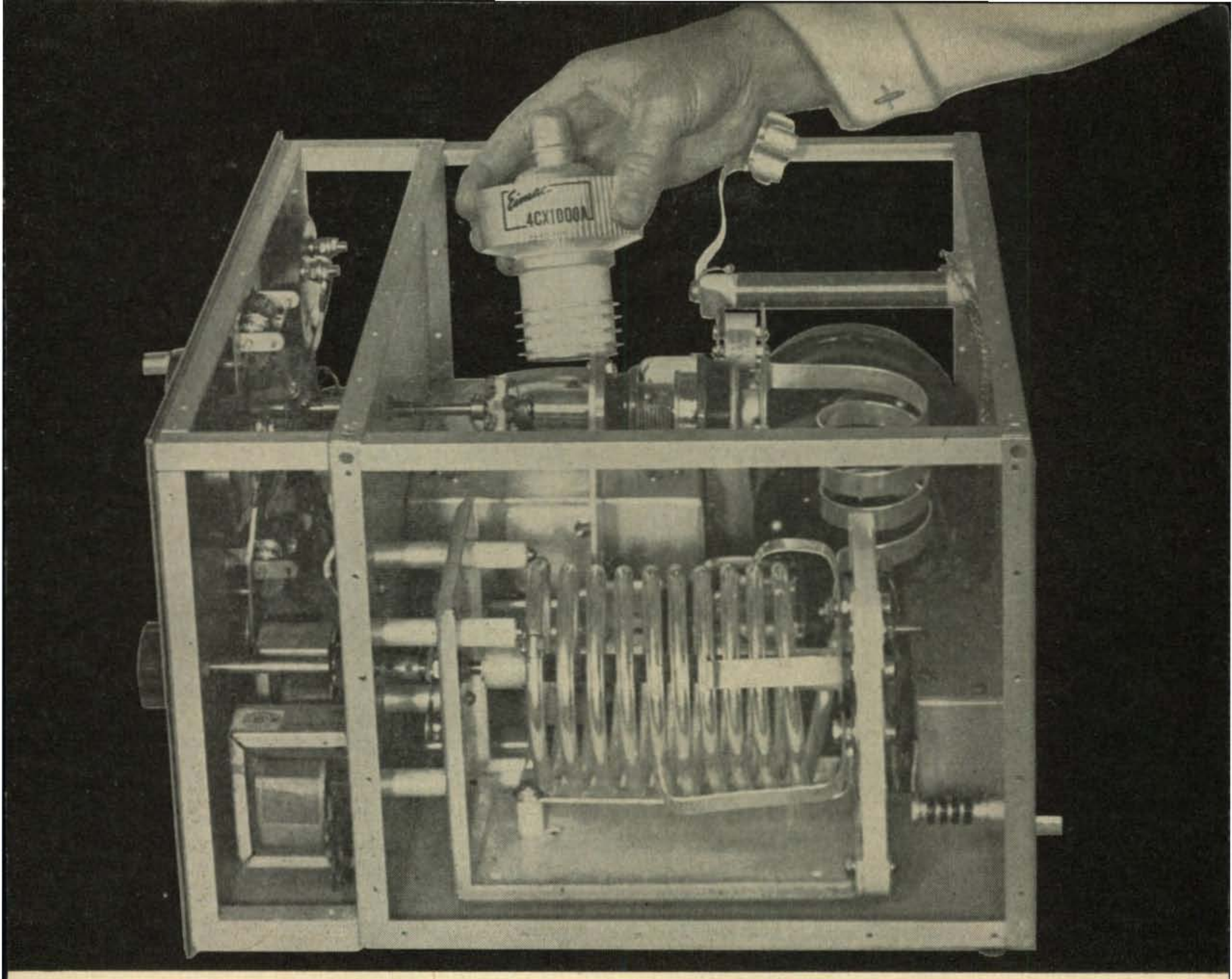
The HARC

The Houston Amateur Radio Club was nice enough to invite me over for a special meeting and I had the pleasure of getting up before the group and talking for about an hour and a half (an hour and thirty-one minutes many of them told me afterwards).

[*Continued on page 22*]

Roth Jones, VK3VG turned up in New York recently and paid a visit to the CQ offices. Roth has been responsible for the series of stories on Australian Antarctic expeditions.

←For further information, check number 5 on page 206.



The Eimac Ceramic 4CX1000A "Casual Kilowatt"

This compact SSB final amplifier, designed and built by Ray Rinaudo, W6KEV, was made possible by the rugged, new Eimac 4CX1000A. Only 4¾ inches high and 3⅜ inches in diameter, the ceramic-metal 4CX1000A is capable of dissipating 1000 watts with only 35 cfm of cooling air. This low-voltage, high-current tube is designed to give exceptionally good linearity in Class AB_1 RF amplifiers. Maximum rated output power is achieved without driving the grid into the positive region, thus eliminating the need for a heavily-regulated driver stage.

In the above amplifier the tuned grid circuit has been eliminated. A 100 watt, 100 ohm non-inductive resistor is used, minimizing feedback and eliminating grid circuit tuning problems.

Eimac stacked ceramic design gives the 4CX1000A excellent immunity to damage by mechanical and thermal shock. Electrical stability and long life are assured by internal ceramic support of the tube electrodes and clean internal design. The Eimac SK-800 Air System Socket provides efficient, trouble-free, breechlock socketing.

Running at legal input, the 4CX1000A will last for years — truly a "casual kilowatt". For full details, write our Amateur Service Department.

For further information, check number 6 on page 206.

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4CX1000A MAXIMUM RATINGS SSB

DC Plate Volts	3000 Volts	Plate Dissipation	1000 Watts
DC Screen Volts	350 Volts	Screen Dissipation	12 Watts
DC Plate Current	1 Amp	Grid Dissipation	0 Watts

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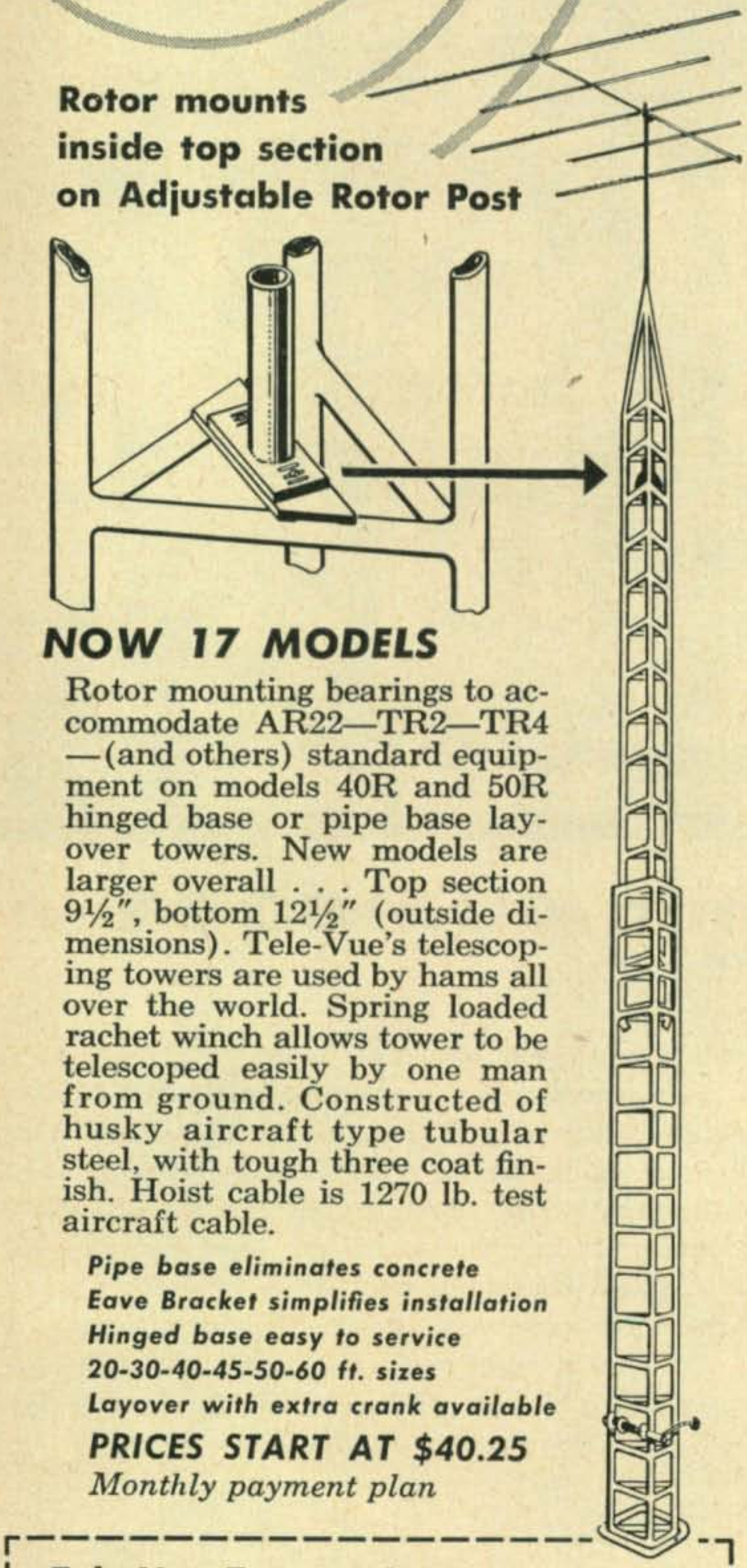
. . . added to the Tele-Vue line



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For further infomation, check number 7 on page 206.

Feenix, Ariz.

Deer Hon. Ed:

Scratchi are being de-miked. You heering of aveyaters being grounded? Likesamewise, I are being de-miked. Off the air. No putting rig on for sixty days. Not even testing filaments of toobs. In fackly, Hon. Ed., not even permitted in Hon. Shack. Lock on door. Only one key. Hon. Brother Itchi having same. Tied to his rist. With wire.

If you not figyouring I in dog-house by now, you ether reeding letter upsides down or you are not paying atenshun. Hackensaki!! Brother Itchi reely putting foot down. Not only putting foot down figyouratively, but also literally. Hon. Ed., he ackchewally kicking me in stomache when Hon. Back are turned.

I not minding so muchly, only are figyouring it not reely my falt. After all, who would eggspecting that sort of thing with material like that? After all, only having to kilowhats into final, and the standing wave rayshow are . . . but maybes better starting back when it are beginning.

Hon. Brother Itchi, XYL-to-be Lil Watanabe and I are having dinner one evenings when Lil asking me how things coming with amchoor radio. I telling her not so hots, on acct. wanting new ten-meters beem, and can't getting as are compleetly out of bux. She saying if I wanting beem that badly, why not making it.

I thanking most kindly for idea, not that are thinking it much of idea, and it are not until after dinner that I beginning to thinking maybes can making beem. Howsumever, more I thinking, more I can't figyouring on how to getting aloominum toobing by making it. Not evening knowing how to make aloominum, much lessly aloominum toobing.

Wondering if can making from aloominum paynt? Brother Itchi having big five-gallons can in barn, are remembering. And that, Hon. Ed., are when 1/c geenyus idea are hitting me!! Paynt, paynted sircuts, beems. I can paynting beem on something! On barn roof! It are having asbestus shingles, and are no better insoolator than asbestus. Also, roof not

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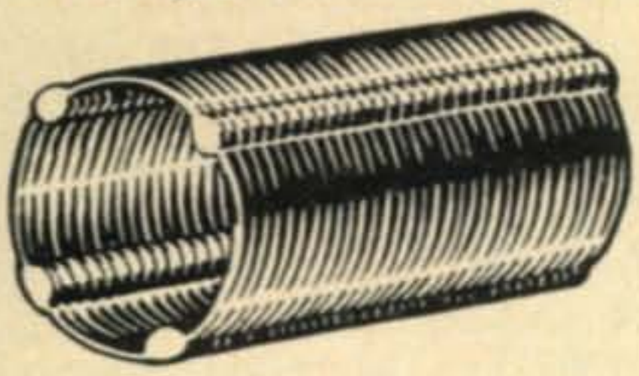
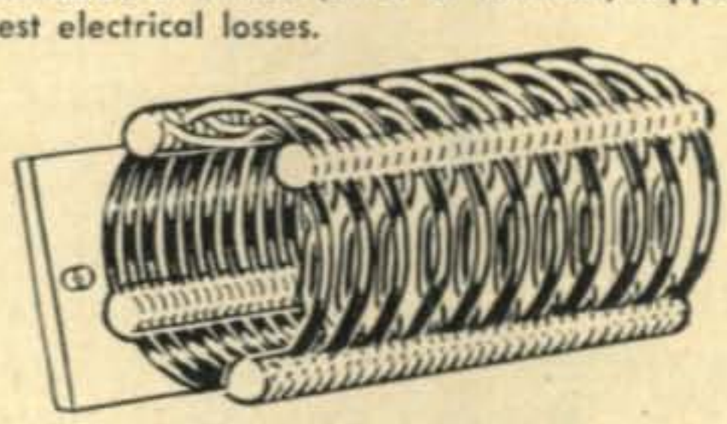
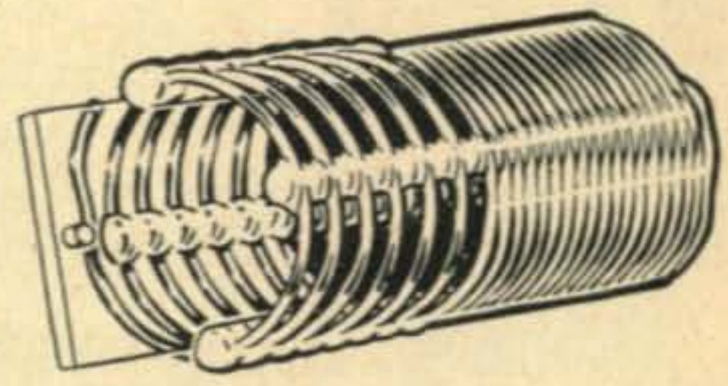
Illumitronic Engineering has developed a complete, versatile series of air core inductors designed especially for the amateur rig, or for prototypes of RF transmission equipment. These coils may be used for pi output circuits, conventional LC output circuits, interstage and oscillator circuits. The series consists of a standard coil type, a variable pitch type, and an indented type, in a range of diameters from ½ inch to 3 inches. All Air Dux® coils are constructed of tinned (silver or formvar) copper wire wound on large low loss polystyrene rods for the highest mechanical strength and lowest electrical losses.



air dux®



indented air dux®



vari-pitch air dux®

air dux coils

Cat. No. "T" or "F"	Diameter in Inches	Turns per Inch	Length of Coil	Wire Size	Total L	Net Price
404	½	4	2	18	0.18	.35
406		6		18	0.39	
408		8		18	0.71	
410		10		18	1.1	
416		16		20	2.87	
432		32		24	11.3	
504	⅝	4	2	16	0.27	.40
506		6		18	0.61	
508		8		18	1.1	
510		10		18	1.6	
516		16		20	4.3	
532		32		24	17.3	
604	¾	4	2	16	0.38	.45
606		6		18	0.86	
608		8		18	1.52	
610		10		18	2.38	
616		16		20	6.08	
632		32		24	24.2	
804	1	4	3	16	1.02	.60
806		6		18	2.33	
808		8		18	4.1	
810		10		18	6.47	
816		16		20	16.3	
832		32		24	66.3	
1004	1¼	4	10	14	5.8	1.45
1006		6		14	13.0	
1008		8		16	23.3	
1010		10		18	36.5	
1016		16		20	94.0	
1204	1½	4	10	14	8.3	1.55
1206		6		14	18.6	
1208		8		16	33.6	
1210		10		18	52.0	
1216		16		20	134.5	
1404	1¾	4	10	14	11.2	1.65
1406		6		14	25.1	
1408		8		14	45.0	
1410		10		16	70.0	
1416		16		18	179.0	
1604	2	4	10	12	14.3	1.75
1606		6		14	33.1	
1608		8		14	57.5	
1610		10		16	89.5	
1616		16		18	232.0	
2004	2½	4	10	12	22.3	1.90
2006		6		12	49.6	
2008		8		14	88.6	
2010		10		16	142.0	
2404	3	4	10	10	31.5	2.85
2406		6		12	71.0	
2408		8		14	127.0	
2410		10		14	198.0	

Silver and formvar available at additional cost

pi air dux coils

indented air dux®

Cat. No.	Dia. in "	Wire Size	Length of Coil	Mtg. Centers	L uh.	Net
816A	1	18	3 3/16	3¾	18	.98
1014A	1¼	18	2 25/32	3⅜	18.3	1.25
1212A	1½	16	2¾	3⅜	18.3	1.50
1411A	1¾	14	2⅝	3⅜	18.0	1.70
1609A	2	14	3	3⅝	18.1	1.85
2007A	2½	12	3¼	4	18.6	2.25
2406A	3	10	3 5/16	4¼	18.7	2.85

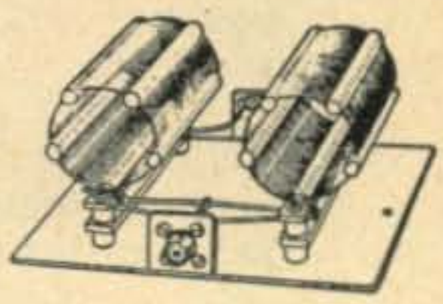
vari-pitch air dux®

820D10	1	18	3¼	3¾	18	1.05
1212D6	1½	14	3 13/16	4⅜	18.6	1.75
1608D6	2	12	4⅛	4⅞	18.1	2.45
2008D5	2½	12	3¾	4⅜	18.2	2.80
2408D4	3	10	3¾	4⅝	18.6	3.50

air dux balun

Air Dux® Balum coils may be used for impedance matching in both transmitters and receivers without adjustment from 10 through 80 meters.

No.	Description	Net Ea.
B2009	Coil with hardware	3.36
MB2009	Mounting Plate	1.95



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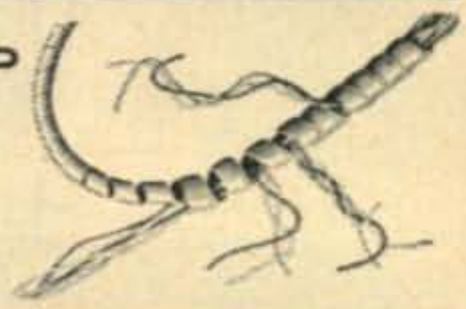

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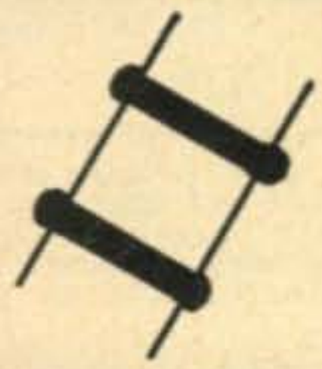

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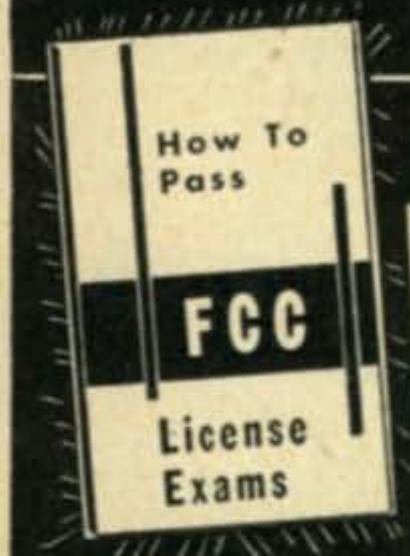

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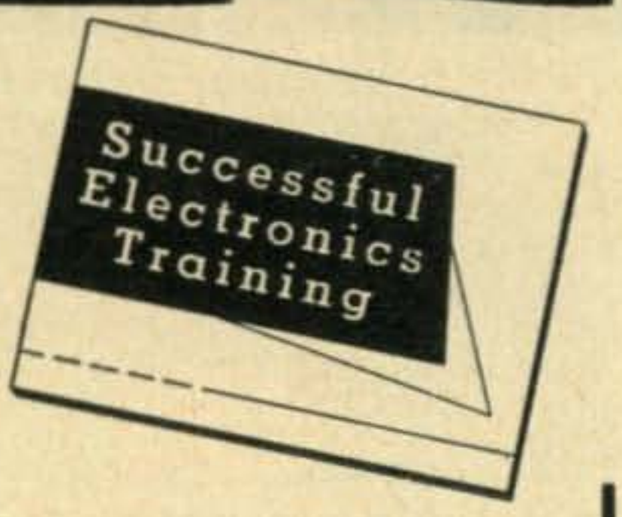

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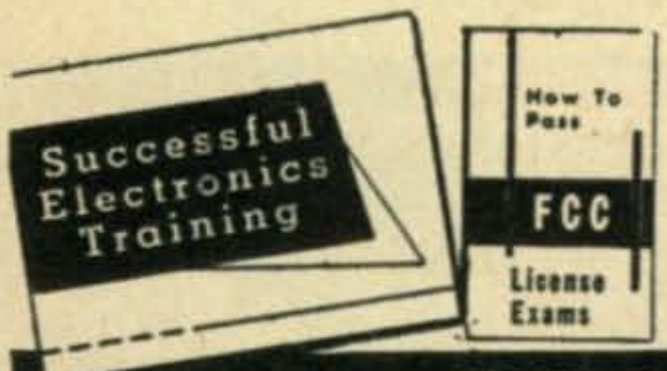

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CQ-32

reel steep, so beem not at too much angle.

That nite figyouring dimensions, how many elements will be having, and just where to placing paynt. Even measuring size of roof on barn by walking around same. Checking to making certainly having enuf wire to feeding beem, and before going to bed are mixing up five-gallons can of paynt.

Next morning, britely and erly, are up on roof of barn. Are running into little trubul making paynt join where shingles overlapping, but by putting on plenty paynt at each joynt seeming to getting good conecshun. By middle of afternoon having all elements nicely in place and are screwing feeder wires into roof and dawbing with more paynt.

Running into shack and checking hole thing with SWR meter and finding have one-to-one raysho. Sacremento!! but this are 1/c geenyus idea. Hooking up eggsiter to antenna and are so ankshus to getting on air I calling seek-you. Quick as wink getting answer from amchoor in Ohio, and he giving me plussedy-plus report.

I telling him to holding on while I increesing powder. Hooking up Arizona Kilowhat to feeders and talking to him, asking howcomes I doing now. He coming back and saying I are strongest signal on Hon. Band and what are I using.

On acct. that reely what I wanting him to asking, I going on and explaneing for abouts ten minutes just how grate an idea I are having, and how I doing it. As turning it back to him, I heer him calling me. He sineing, I going back. Listening, and he not heering me. Looking at plate meter. Hokendoke!! it are off-scale—something happening to antenna.

Running like furies out to barn before getting there heering Itchi's cows yelling like wounded bulls. One cow can making plenty noyse, but heering eleventeen cows—Hon. Ed., it are horrendus.

As are rushing in barn door something reel hot are hitting me on top of Hon. Hed. Looking up, and seeing that roof are dripping, from insides!! I are just beginning to figyouring out what are happening, when Hon. Brother Itchi coming thru door and yelling at me to helping him getting cows out.

Hon. Ed., no use boring you with all the grewsome detales. Are you knowing that asbestus shingles not having much asbestus in—they mostly tar? Are you knowing that tar having nice loss at radio freakwencies? Asbestus shingles not burning, but they shurely melting like sixties.

So, not having muchly to do for sixty days. Yes indeedy, after I getting tar spots off backs of eleventeen dozen cows, and nailing up new aloominum roof on barn, I not having anything to do. Say, Hon. Ed., you thinking that if I supporting that aloominum roof on insulators, I could using it as top-loded beem?

Respectively yours, Hashafisti Scratchi

The New Ideas *in communications are born at* hallicrafters

Brilliant performance! The SX-99 receiver features broadcast coverage 540-1680 kc plus three S/W bands, 1680 kc—34 mc. Bandspread calibrated over 10, 11, 15, 20, 40, 80 meter amateur bands. Antenna trimmer, "S" meter, crystal filter. Seven tubes plus rectifier. Black cabinet, silver trim, piano hinge top. **Model SX-99—$149.95**

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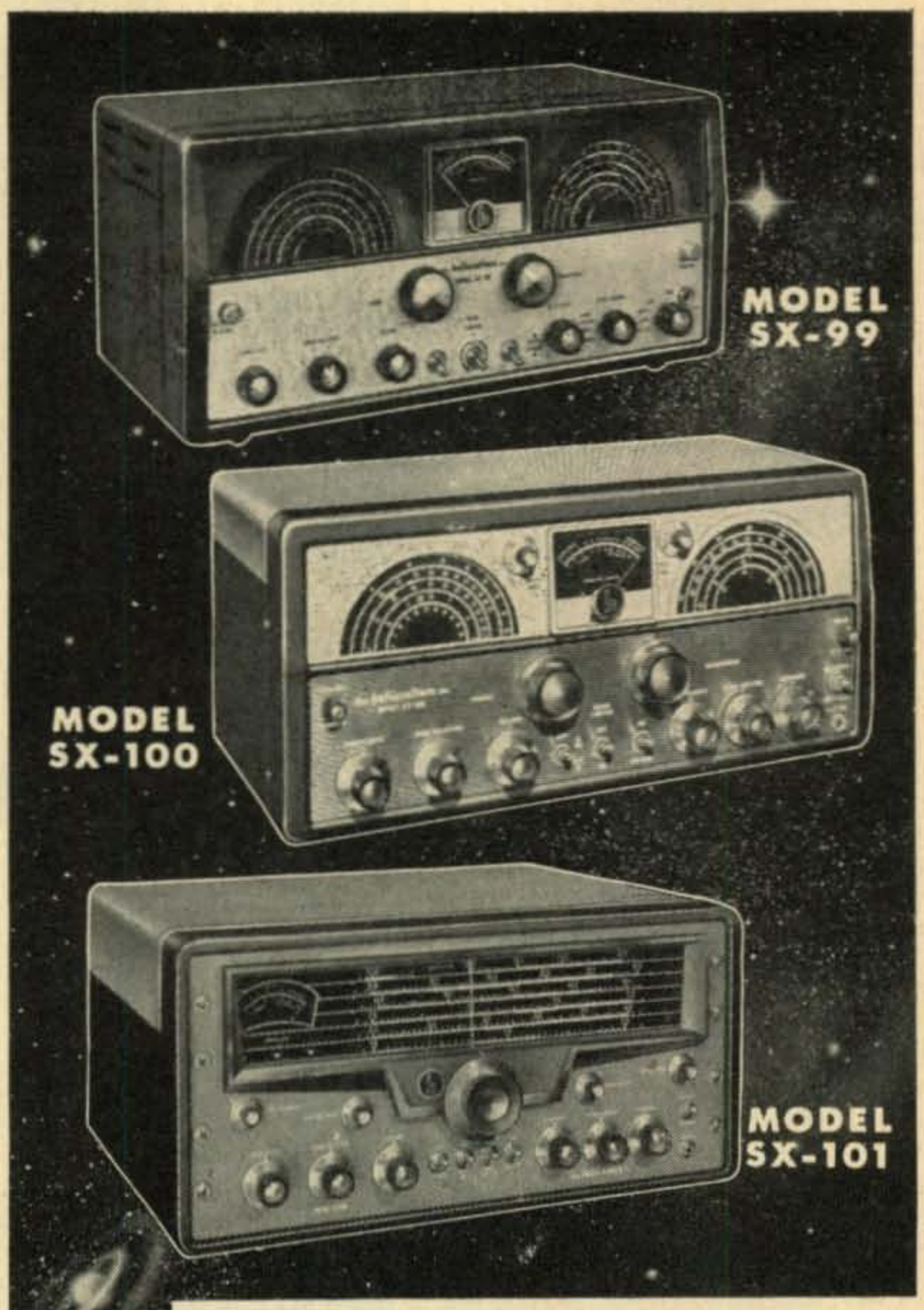

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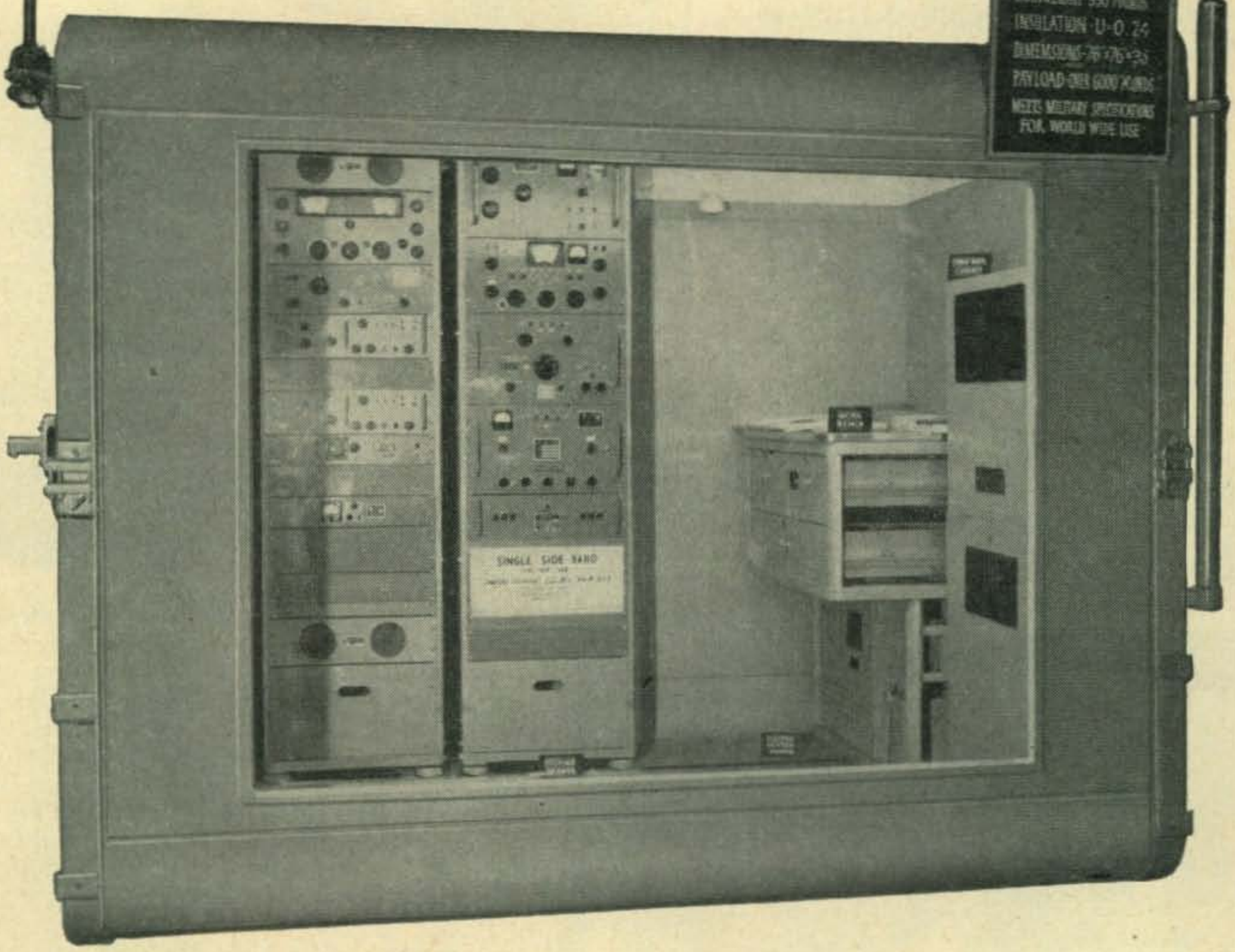
A MODERN

Illustrated below is a new "helicop-hut" installation complete with SSB & RTTY transmitting and receiving terminal equipment.

The "helicop-hut," as designed and manufactured by Craig Systems Inc. of Danvers, Mass., is easily transported by helicopter and other prime movers.



It is interesting to note the number of TMC commercial products which bear armed services nomenclature in this installation such as—

GPR-90	**Receiver**	**R-825/URR**
MSR	**Mode selector**	**CV-591/URR**
FFR	**Receiver (fix tune)**	**AN/FRR-49(v)**
SBE-1	**Sideband Exciter**	**AN/URA-23**
PMO	**Variable precision Oscillator**	**O-459/URT**

YOU CAN DEPEND ON IT! TMC MEETS ITS PUBLISHED SPECIFICATIONS.

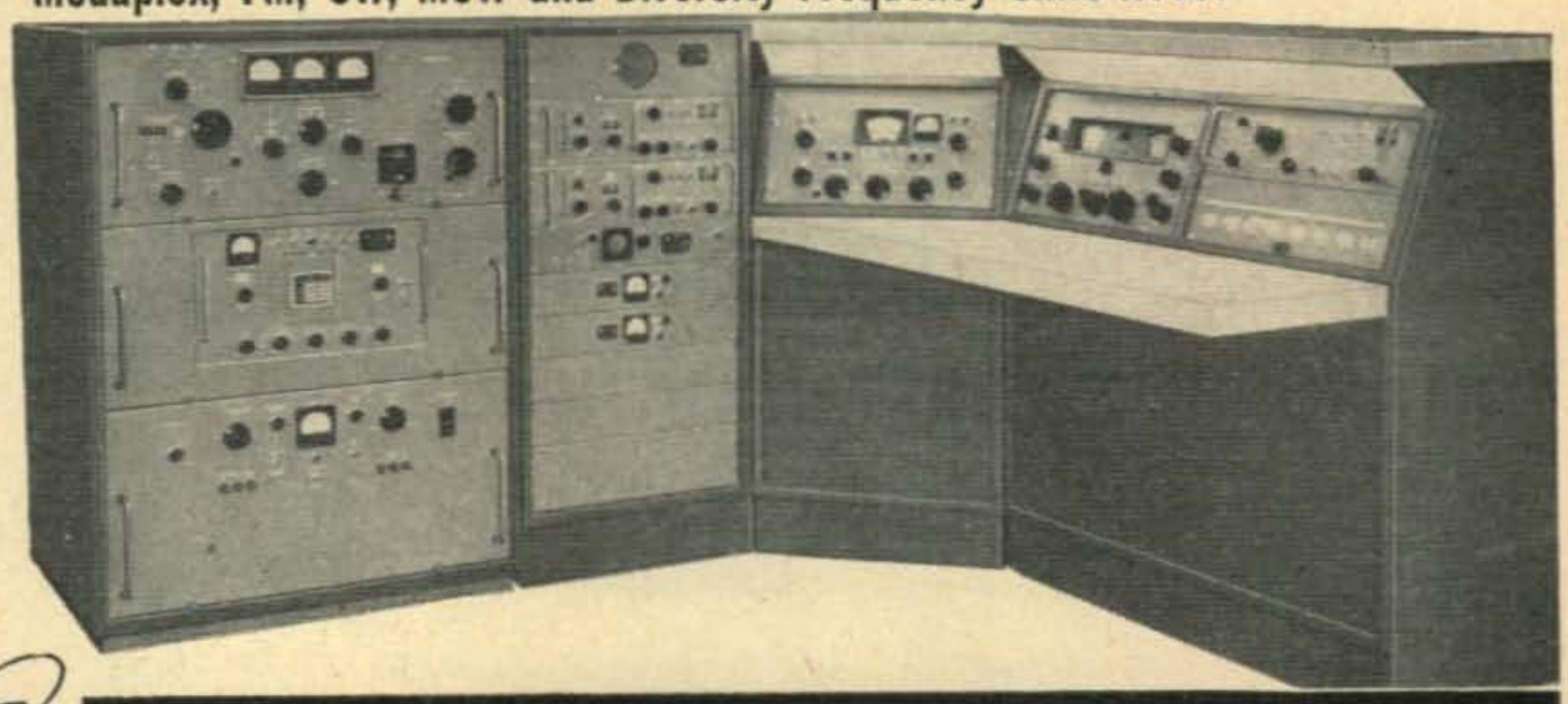
SKYHOOK!

or . . .
just
another
way to
deliver
a
TMC
STATION
anywhere
in the world!!!

The Series 5800 Station shown below can also be easily transported by helicopter in crated form.

Provides a complete SSB, AM, CW, MCW and FS Transmitting and Receiving facility. Continuous frequency coverage 2 to 32 mcs band-switched. Up to 1100 watts output CCS.

Modes of operation: Single Sideband, Two Independent Sidebands, Double Sideband (all with adjustable carrier insertion), Conventional AM, Moduplex, FM, CW, MCW and Diversity Frequency Shift RTTY.



COMPLETE BULLETINS AVAILABLE ON REQUEST

The TECHNICAL MATERIEL CORPORATION

IN CANADA
TMC Canada Ltd., Ottawa, Ontario

Main Office: MAMARONECK NEW YORK

For further information, check number 10 on page 206.

Here's the "coolest" sub-miniature rotary switch available...

Centralab PS-100

- **weighs less than 1 oz.**
- **dia. is less than 1 in.**

Dust off those pet projects of yours that have been side-tracked for lack of the right sub-miniature rotary switch. The PS-100 is ideal for band switching, ultra-small electronic equipment, transistor circuits, and a host of other sub-miniature designs.

Its deluxe 1/8" thick ceramic sections repel surface moisture. The PS-100 offers up to 3 sections, 12 positions each. Make and break, resistance load, .5 amp. at 6 volts d.c.; 100 milliamp. at 110 volts a.c. Current-carrying capacity, 5 amp.

Military, commercial, and industrial designers swear by it. You'll like it. Ask your distributor about the PS-100. It's illustrated on page 11 of Catalog 30. If you don't have a copy, ask for one. Or write to Centralab.

Centralab

954K EAST KEEFE AVENUE • MILWAUKEE 1, WISCONSIN
In Canada: 804 Mt. Pleasant Road • Toronto, Ontario
P-4558

For further information, check number 11 on page 206.

Letters . . . to the editor

The YL Fights Back

Sir,

Most husbands, I've been led to believe, are considerate enough, but that OM of mine most certainly never was! He turned into one of those Ham "Monsters" and began to forget to kiss me when he came home from work. He never asked me how my day went, or how the children were. He would just rush in the door, and make a bee-line for that trash-pile he calls a radio shack. He would lock all his doors, throw a bunch of switches, and fill his ears with wild, nerve-racking screeches.

I remember one particular day when he came home and followed the procedure outlined above. I had dinner prepared, and it was all ready to put on the table, so I sat down and began to figure a way to get him to come out to eat. Just for laughs, I thought I would try calling him for a change.

"Dinner's ready, Darling!" I casually sang. I cocked my ears to hear through all the QRM in the shack, and presently the locks moved, and the door swung open. To my utter amazement, the OM burst forth.

"Have you seen my soldering gun?" he asked. Looking past me, he spotted the gun on the chair by the table. He darted forward, snatched the iron, and disappeared back into his hole before I could protest.

"Your dinner's getting cold, Baby Doll," I called sweetly. He answered by turning up the receiver again full blast. I began to get a little shock.

"K6—! Here is ur XYL—Calling and sitting by!" I stuck my ear to the door to see if he copied.

"Sorry, OM," he was saying politely, "Little QRM on you that time. Better give me that again."

A trifle irritated at this point, I went into the kitchen, and returned with a hammer. Being a little familiar with the code, I very lightly tapped out "CHOW" on the shack door, splintering the panel. I listened.

"Can't copy, OM . . . some lid is sending cw on ur frequency."

Still undaunted, I retreated to reorganize my attack. Deciding on a new offense, I grabbed the scissors from the sewing machine drawer, and zipped out the back door. His transmission line was no problem at all for my pinking shears, and it gave easily after two snips. Smiling coyly at my genius, I raced back into the house to see my results. After hiding the shears, I waited at the dining room table. He would be sauntering out in no time, I calculated. I waited a few minutes, but still no sign of the beast from 50 million cycles. I snuck up next to his door again, and put my ear to the keyhole.

"I was in QSO with a guy down on forty a few minutes ago," he was saying, "but the band folded suddenly, so here I am on six."

To heck with dinner. I got myself a ticket, and now have a rig sitting where the dining room table used to be. Once in a while I have a QSO with the OM. He's not such a bad guy once you get to know him. He does have his faults, though. It seems he always wants dinner when the skip is in.

K6BNU
Los Angeles, Calif.

ZL Special

Dear Wayne,

I have received so many requests for construction data on the antenna in use here at my station that I thought it may warrant a letter to you for possible publication in some future issue of CQ Magazine.

The heap of plumbing atop a 32 foot telephone pole in back of the shack is a Double Folded Dipole, Zed El Special, rotary beam. It is designed for twenty meters, but a strange and welcome discovery reveals that it loads beautifully on ten and with care, produces a pat-

(Continued on page 20)

Well pleased with it

Very fine recvr.

LOOKS REAL GOOD!

VERY FINE BUS

FB rig

PERFORMS WELL!

VERY FINE WORKMANSHIP — AMAZING COMPACTNESS

LIKE IT OK!

WONDERFUL

I'm glad I waited for it!

A LOT FOR $229*

LIKE ITS SELECTIVITY

Sounds terrific on SSB

WORKS 100%

WHAT MORE CAN WE SAY, EXCEPT—

Get yourself an HQ-110 as soon as possible!

*Telechron clock-timer, $10 extra.

• *Send for complete details. Ask for Bulletin Q1157.*

Established 1910

HAMMARLUND

HAMMARLUND MANUFACTURING COMPANY, INC., 460 W. 34th ST., N.Y. 1, N.Y.

Export: Rocke International, 13 E. 40th St., N. Y. 16, N. Y. Canada: White Radio, Ltd., 41 West Ave. N., Hamilton, Can.

For further information, check number 12 on page 206.

BOXED, WRAPPED and DELIVERED!

IDEAL

CHRISTMAS GIFTS

for HAMS!

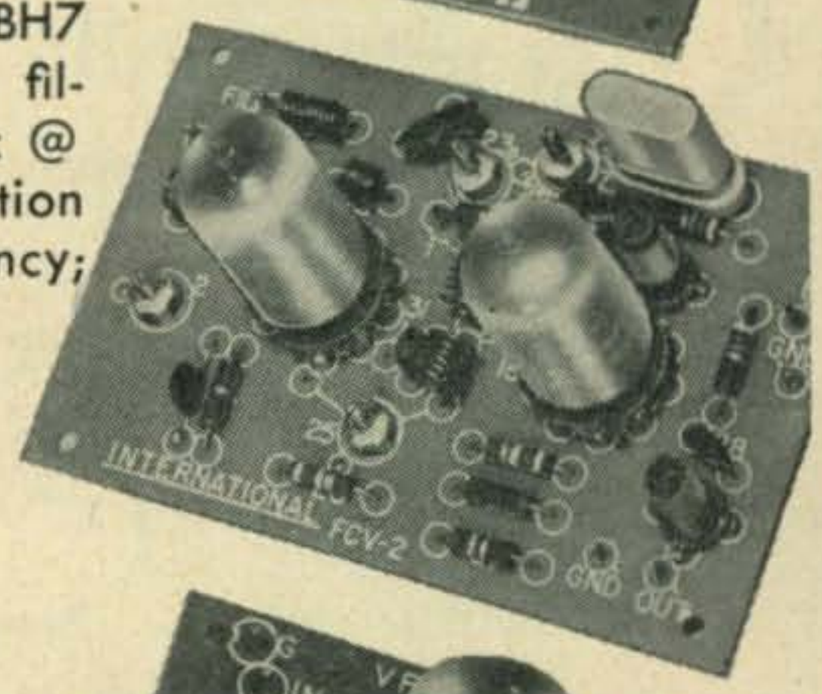
Last year we contributed to the happiness of many a Ham Radio Shack, sending International units made to exacting standards, to a great number of people as Christmas Gifts. Now, as an early gift suggestion, we offer the following:

T-12 TRANSMITTER 3500-4000 KC 7000-7300 KC

Only 3½" x 6" x 3¼" . . . makes many DX contacts with careful operation under good conditions. Pi-network output enables operator to couple into almost any type antenna. Low drive oscillator with International FA or F-6 crystals; may be used in close tolerance applications. 12BH7 Oscillator-buffer and 5763 final. Power requirements: filaments 6.3 VAC @ 1.35 amp. Plate supply 350 volts dc @ 50 mils. Separate B+ input connection to final for addition of modulation. Crystal frequency same as output frequency; uses straight through operation!

T-12 Wired with tubes and one 80 or 40 meter crystal (Specify) **KC $15.95**

(Kits for assembly also available)



FCV-2 CONVERTER 2 METERS 6 METERS

• Model 50 - 6 Meters • Model 144 - 2 Meters

A 6U8 tube is used as oscillator-mixer. Cascode r-f amplifier using 6BQ7A. IF outputs available from broadcast band through 30MC. Designed to mount in a standard 3 x 4 x 5-inch minibox.

Kit with crystal (less tubes).....$12.95
Wired with crystal and tubes..... 17.95

VFA-1 CASCODE PRE-AMPLIFIER

For 2 Meters and 6 Meters, using the 6BQ7A in a low noise circuit. Designed to mount in a standard 3 x 4 x 5-inch minibox.

Kit, less tubes.....$ 4.75
Wired, with tubes..... 6.95

IFA-10 I.F. AMPLIFIER

For use between converter and receiver. Uses 6AH6 type tube. Available for I-F ranges from broadcast band through 30MC. Designed to mount in a standard 3 x 4 x 5-inch minibox.

Kit, less tube.....$ 5.75
Wired, with tube..... 8.50

HOW TO ORDER: Please furnish name (or names) and address of those to receive gifts. Send your Gift Card for each gift-wrapped unit, and state shipping time desired. International will then handle as indicated. (Check or money order must accompany your order).

International
CRYSTAL MFG. CO., INC.
18 N. LEE PHONE FO 5-1165 OKLAHOMA CITY, OKLA.

For further information, check number 13 on page 206.

NEW!

TMS-500 Coaxial Switch

Makes Easy Change From Cable Video to Air Reception!

PROVIDES HIGH DEGREE OF ISOLATION!

The New TMS-500 Coaxial Switch, for Cable Video or Air Reception to a Single Television Receiver, provides an exceptionally high degree of isolation with no interaction between two incoming signals . . . makes for precise switching of either of two RF signals to a common output. (Now being installed as part of the "World's First Telemovie" service, bringing the theatre's finest, first-run movies into the home via television).

DATA

Nominal Impedance.....75 Ohms
VSWR.....Less than 1.2
Response.....Flat .0 to 250 MC
Insertion Loss.....Less than 0.5 DB
Isolation.....Cable to Cable, at least 80 DB.
Either Cable to Set, from Open Position, at least 65 DB.
Connections.....Coaxial Cable RG-59/U Solderless
Mounting.....Two Single Hole Clip Brackets

TMS-500 Coaxial Switch.....$9.50

LOW COST UNIT
WIDE BAND, LOW VSWR
VERSATILE APPLICATION

TWO MATCHING TRANSFORMERS for TMS 500

TMT-400 Twin Lead Pigtail..... 2.10
TMT-700 Screw Terminals..... 2.50
Band Pass.....20 MC to 250 MC
Impedance.....75 Ohm Cable/300 Ohm Set
VSWR.....Less than 1.2
Fittings.....RG-59/U Solderless Connectors
Transformer Dimensions.....1" dia. x 1¼" long

HOW TO ORDER: Electronics Coaxial Switches, Cable Taps, Printed Circuit Units, etc. are sold direct for fastest service . . . shipped prepaid when cash accompanies order Otherwise C.O.D

TMT-700 TMT-400

Manufacturing A COMPLETE LINE of
- Printed Circuit Units
- Complete Line Frequency Test Instruments
- Cable Taps
- Sub-Channel Converters
- Video and Sound Modulators

Electronics International, Inc.
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18 N. LEE PHONE FO 5-1165 OKLAHOMA CITY, OKLA.

For further information, check number 13 on page 206.

FRONT PANEL OPERATING CONTROLS

Emission switch with 5 positions for selecting CW PM — AM or DSB — Sideband 1 — Sideband 2

Indicator Switch —
Position 1. Tuning eye indicates R.F. output.
Position 2. Tuning eye indicates when flattoping occurs.

Valuable aid for tuning up on AM and as a Distortion indicator for SSB.

"Phasemaster II-A" complete $329.50
"Bandhopper" VFO complete $139.50
P-400 Grounded Grid Linear Amplifier $269.50

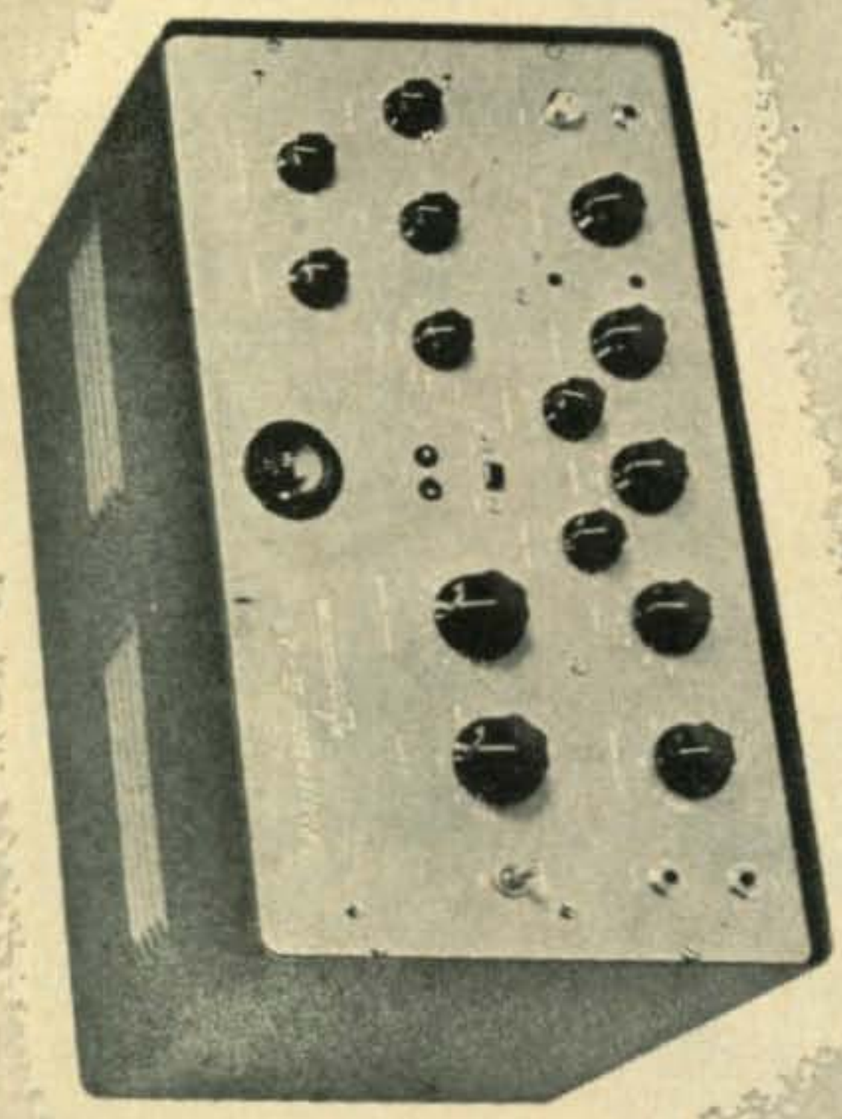
Price and design subject to change without notice.

See Your Dealer or Write Today

Lakeshore INDUSTRIES

MANITOWOC, WISCONSIN

MANUFACTURERS OF PRECISION ELECTRONIC EQUIPMENT



ALL BAND OPERATION

"Phasemaster II-A"

IMPROVED AND ADVANCED OPERATING FEATURES

SSB or DSB suppressed carrier or with carrier, PM and CW.

6146 power amplifier delivers 65 PEP watts output, giving sufficient power to drive nearly all types of linear amplifiers INCLUDING grounded grid finals.

Calibrate control allows variable control of signal for zero beating VFO to receiver frequency or TOF (talk on frequency.)

Voltage Regulation of 6146 Screen and 9MC OSC.

Temperature compensating condensers in critical 9MC circuit for improved stability.

For further information, check number 14 on page 206.

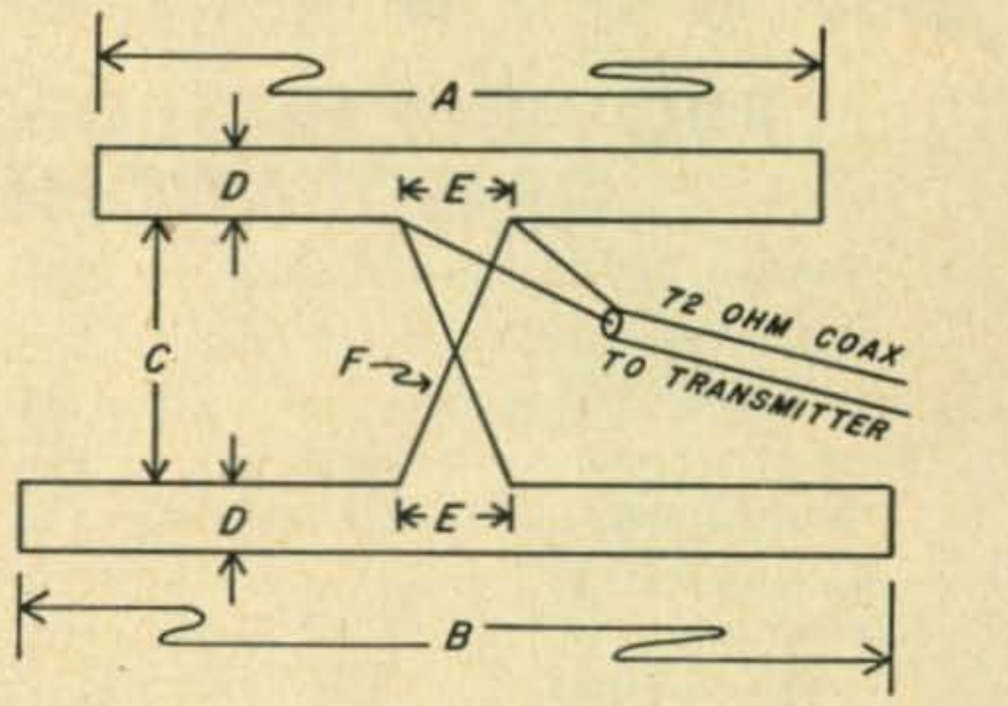
Letters *[from page 16]*

tern similar to a dipole on fifteen. Test instruments not being available at this QTH, I can only make estimations as to operating data and pass them on as they appear to me. Forward gain is in the vicinity of 10 db, front to back 20 db, fed directly with 72 ohm coax and the dimensions given later best for around 14.2 mcs. Some of the fellows that have used beams similar to this one will probably throw up their hands and say the rear element shouldn't do a thing since it isn't long enough! But, consistent signal reports of the highly flattering variety establishes a pretty good argument at this end! I respectfully submit the calls of W1JFG, W2BND, W2KFA, W2KW, W4HBQ (I could go on!) as references to the foregoing statement.

Follows a schematic and the dimensions of the Zed El as used at DL4SK. In case some of the experimenters try this beam out for test purposes, I would be very interested in hearing the results of the tests using the dimensions given. Incidentally, I'll be returning to the States by the 15th of July and my address there is, 1115 Little Bay Avenue, Norfolk 3, Virginia.

Let's hear from some other Zed El users!

Ira B. White, Jr.
DL4SK, W4BGP



Well, It's Legal . . .

Dear Sir:

Here's a picture that may need a bit of explanation. Two cars with the same license number and both in operation?

Well, it's legal, just the same. The black one is a 1956 plate and the white one is for 1957. In this state, new plates go on and old ones come off any time between March 15 and April 15. This picture was taken on April Fool's Day, but actually we weren't trying to fool anybody.

Julian S. Hatcher, W4RNQ
Falls Church, Virginia

Forgotten (?) Band

Dear Wayne:

Just thought I'd drop you a line to tell you that I really enjoyed your informative article "SWLing And The Forgotten Band," in the August CQ.

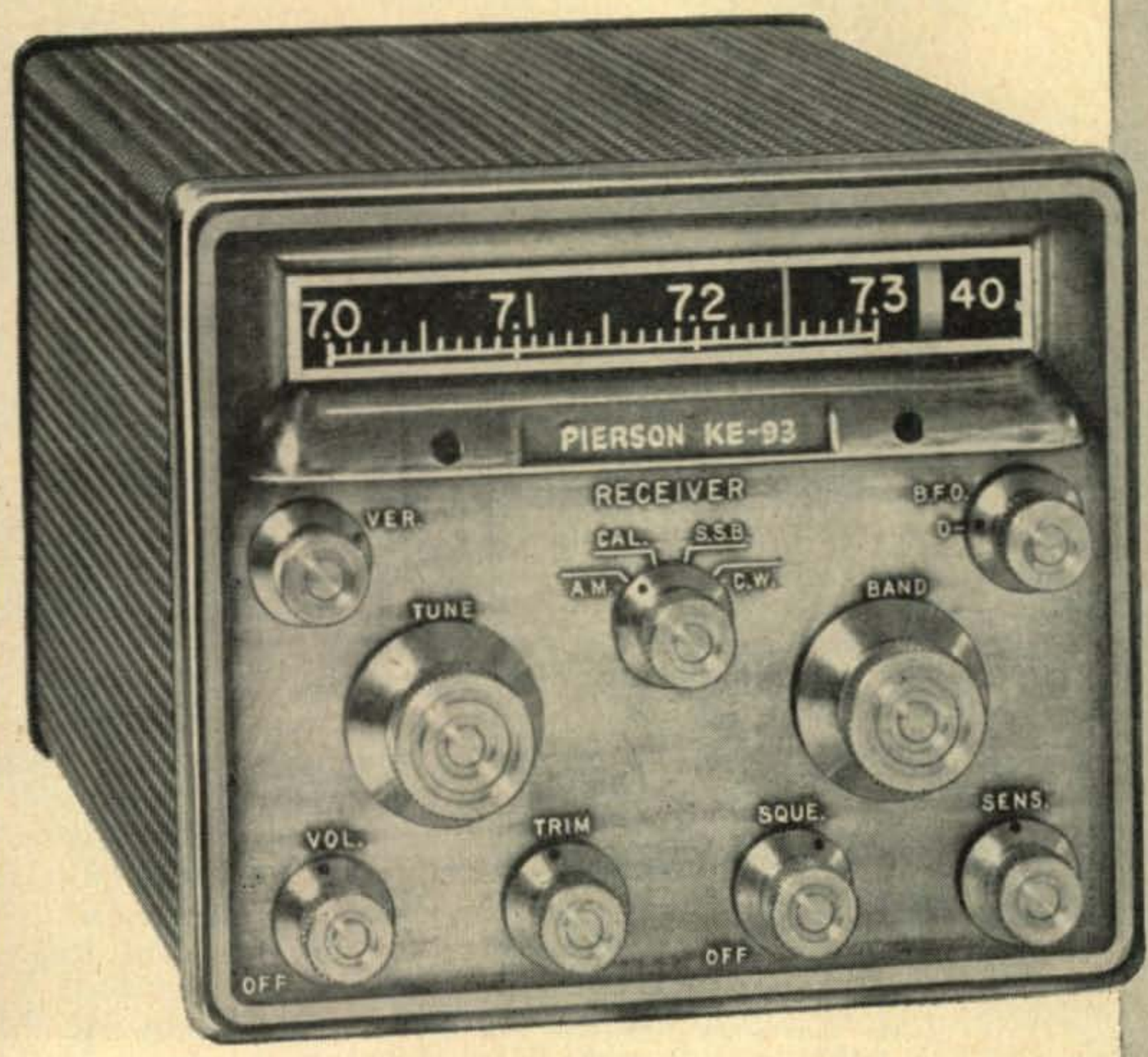
As an actual user of this segment of the radio spectrum, I can attest to the magnitude of interesting

(Continued on page 207)

new, improved

PIERSON KE-93

communications receiver



A Full-Fledged 12-Tube All-Band Communications Receiver In A Small, Mobile Package!

Built to outperform existing mobile receivers, the Pierson KE-93 equals and surpasses many receivers of the large console variety. Extremely small and compact, the KE-93 Receiver is designed for either mobile or fixed station operation. It delivers high over-all performance on seven bands; 10, 15, 20, 40, 80, 160 meters, and broadcast band. In addition, it features a new functional design and simplified control operation. Best of all, it bears the name of Pierson, whose more than 25 years of radio-engineering know-how have produced many outstanding receivers familiar to veteran hams the world over.

- Dual conversion, crystal second mixer, virtually eliminates image responses
- Dial displays only the band in use. Indirect lighting provides non-glare readability of large legible lettering.
- Plated satin finished panel styled to match the most luxurious car interior.
- Each ham band spread over entire length of dial.
- Extreme selectivity and sensitivity.
- Size: 6″ wide, 5″ high, 9″ deep.
- Rigid construction, die cast panel and turret housing.
- Highly effective noise silencer and squelch circuits of new design.
- Provisions for external S meter.
- Controls in most practical and convenient operating panel position for mobile operation.
- Function switch provides ideal settings for A.M., C.W. and S. S. B. operation. Excellent S. S. B. reception even in "mobile in motion" operation.
- Versatile, 7 position turret band switching.
- 6 or 12 V.D.C. or 110 V.A.C. power packs permit mobile, fixed, or portable operation.
- Competitively priced.

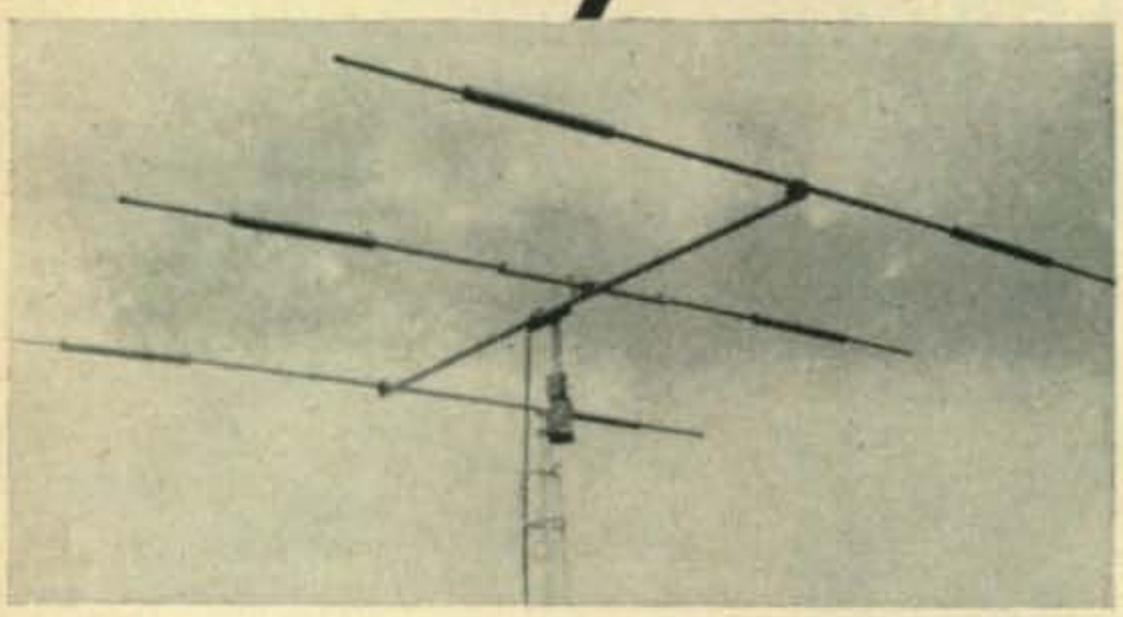
AUTOMATION ELECTRONICS, INC.
1500 West Verdugo Avenue, Burbank, California

WRITE TODAY FOR COMPLETE DETAILED INFORMATION

For further information, check number 30 on page 206.

New & Different!

the Mosley TRAP MASTER



3 Bands ... 10, 15 & 20!

Model TA-33 $99.75

it's the design . . .

New! Different! And, we might add, – *Better!*

From the *exclusive* MOSLEY trap design– that defies rain, dust *and* time, to the sturdy, all-aluminum construction that needs no help from clothes-line or other boom-supporting devices; the MOSLEY "TRAP–MASTER" Beam reflects typical MOSLEY *Value, Quality and Workmanship!*

Performance? Up to 8db forward gain on each band with 25db, or better, front-to-back. SWR, 1.5/1 at resonant frequencies.

Write for Specification Sheet, No. TR-1, and read the complete story of the MOSLEY 3–Band "TRAP-MASTER". Get set for Fall and Winter DX fun–order *your* "TRAP-MASTER" Beam from your favorite Ham Dealer . . . *Today!*

You can't go wrong – it's MOSLEY!

Mosley Electronics, Inc.

8622 ST. CHARLES ROCK ROAD, ST. LOUIS 14, MISSOURI

Exp. Dept.: 15 Moore St., New York 4, N.Y.

For further information, check number 16 on page 206.

de W2NSD [*from page 8*]

Quite a few of them came down to the Convention in San Antonio a couple days later to hear another hour. Texans are tough. They sure do have an amazing club though. I snapped some pictures to try to give you a better idea of the whole thing.

San Antonio

As a gourmand and bon vivant I descended upon the best Mexican restaurant and . . . hold on, you want to know about the Convention. Well, let me say that this turned out to be a well organized one, and that I sure enjoyed it a lot. Everyone I talked with seemed to share that opinion . . . congratulations to the committee.

Bernie (W5YVJ), Ed (W5SDA) and I drove over from Houston and, after checking into the hotel, finally found the Friday Night picnic supper out at one of the local breweries. After eating several pounds of enchiladas, frijoles, tostadas, etc., I chewed the rag with old friends until way past bedtime.

The next morning I hurried down and listened to as many of the scheduled talks as I could manage. Then I spent a while wheedling those Texans out of their oil money for a CQ subscription. Such sales resistance! In the afternoon I put aside my stage fright and talked about everything I could think of to the assembled multitudes. Guess I rambled on for an hour, at least. I covered things like double sideband, flying saucers, the latest in anti-gravity, and the poor grade of sunspots we are getting this cycle.

The Houston Amateur Radio Club has this huge club building for their meetings and station. They certainly have one of the most elaborate club houses that I have ever seen. The top air conditioner is for the hamshack, the bottom one for the code classroom. Another, gigantic unit, cools the main auditorium and snack bar.

HERE IT IS!

THE VIKING "COURIER"

500 WATT LINEAR AMPLIFIER

Continuous coverage 3.5 to 30 megacycles . . . instant bandswitching 80 through 10 meters!

The new Viking "Courier" delivers full communication power — rated a solid one-half kilowatt P.E.P.* input as a class B linear amplifier; one-half kilowatt input on CW or 200 watts in AM linear mode; in a completely self-contained desk-top package. The Viking "Courier" may be driven by the Viking "Navigator," "Ranger," "Pacemaker" or other unit of comparable output. Drive requirements are 5 to 35 watts depending upon the mode and frequency desired. The linear amplifier employs two Type 811A triode tubes in parallel. Pi-network output circuit is designed to match nominal 40 to 600 ohm antenna loads and will tune out large amounts of load reactance as well. Continuous coverage 3.5 to 30 megacycles (bandswitched) — high efficiency, pi-network output circuit. Fully TVI suppressed and filtered; completely self-contained with built-in power supply.

$244.50 AMATEUR NET

Cat. No. 240-352-1 Viking "Courier" Kit with tubes.....

Cat. No. 240-352-2 Viking "Courier" wired and tested with tubes..... **$289.50** Amateur Net

*With an auxiliary SSB exciter.

*Proper wave shaping of the keyed signal, producing a clean, crisp CW note free of clicks and chirps, is essential in high-power operation. Information necessary to modify units without the famous Johnson Timed Sequence Keying System will be made available upon request.

"COURIER" POWER GAIN

Driver*	Power increase-times
Adventurer .....CW	10.0
Navigator .....CW	12.5
Ranger .....CW	6.6
Ranger .....AM	2.5
Viking I & II.....CW	2.8
Pacemaker .....SSB & CW	5.5
Pacemaker .....AM	5.0

See your authorized Johnson distributor for easy payment terms!

E. F. Johnson Company

2824 SECOND AVENUE S.W. • WASECA, MINNESOTA

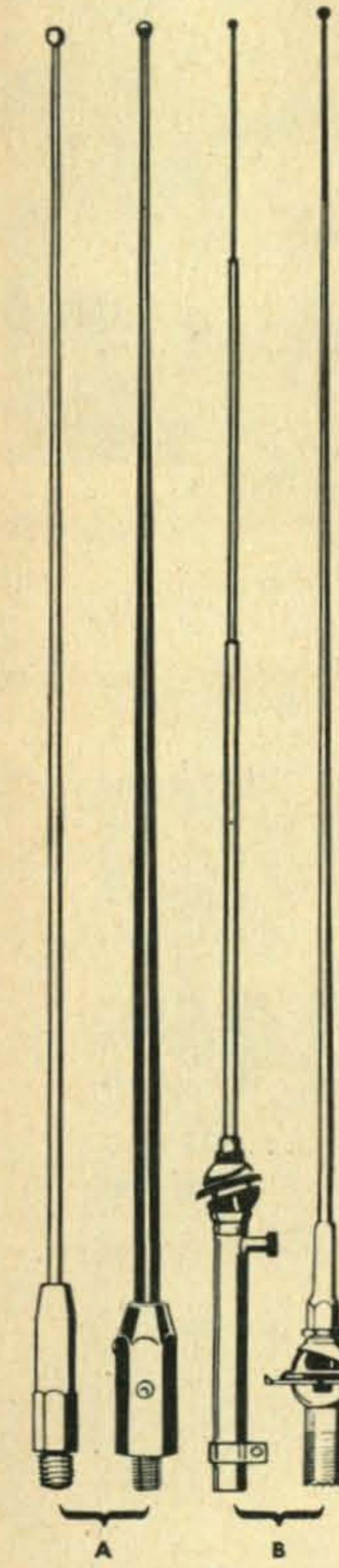
For further information, check number 17 on page 206.

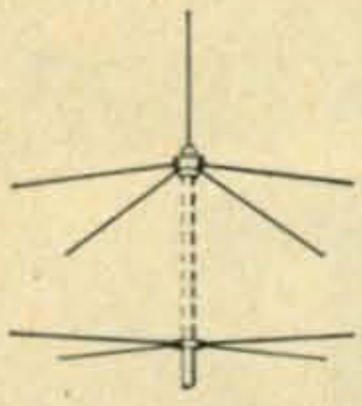
NEW

complete line for communication

WARD ANTENNAS

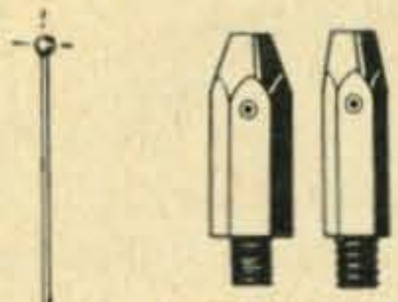
Pioneer antenna maker now adds new bases, new masts, and new springs for all of your requirements . . . in all price ranges.



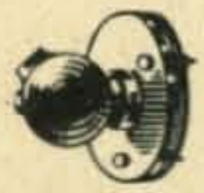


GROUND PLANE ANTENNAS

SPRINGS
3 TYPES



ADAPTERS — CADMIUM PLATED OR STAINLESS



BASES—BOTH STANDARD & COAXIAL BLACK & CHROME

A

HEAVY DUTY MASTS—STAINLESS AND FIBERGLAS

B

DISGUISE ANTENNAS—FOUR MODELS

C

ROOF TOP ANTENNAS—THREE EFFICIENT MODELS

A B C

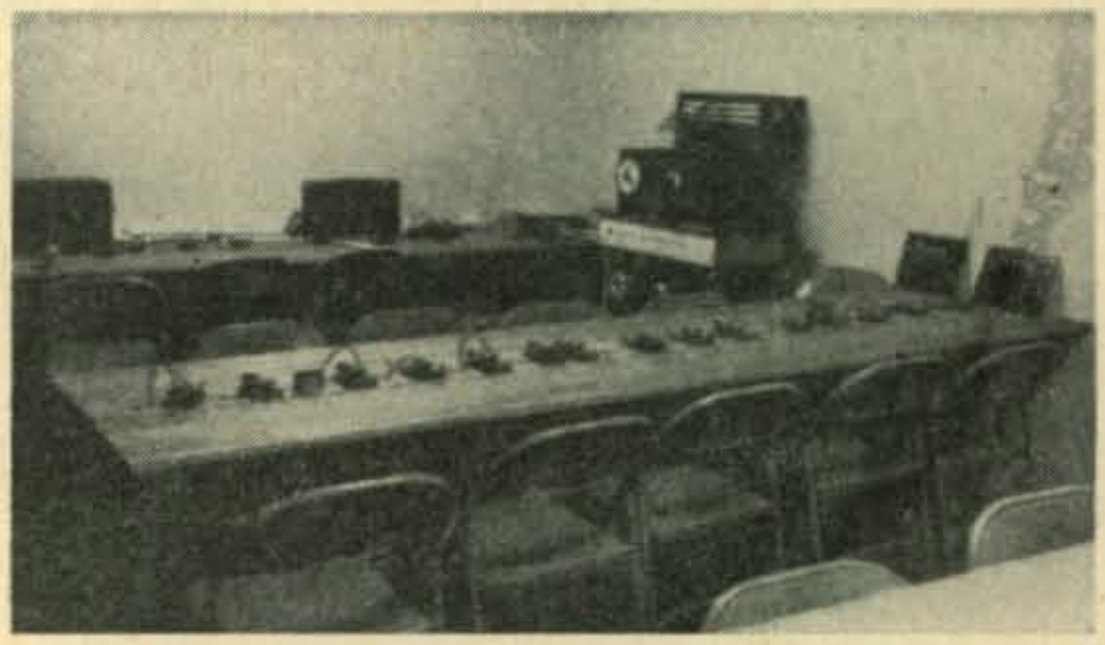
See distributor or write for newest catalog

Ward PRODUCTS CORPORATION
A division of THE GABRIEL COMPANY
Dept. CQ — 1148 Euclid Ave. — Cleveland 15, Ohio

In Canada: Atlas Radio Corp., Ltd.
50 Wingold Ave., Toronto, Ontario

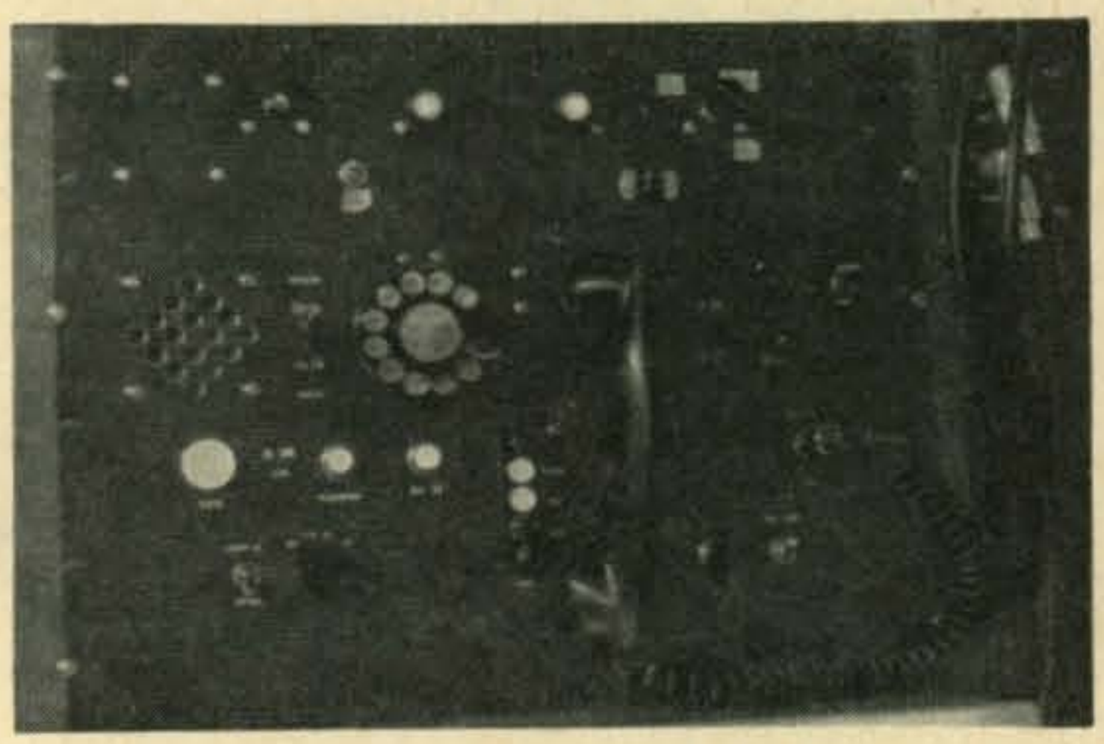
For further information, check number 18 on page 206.

Left to right W2NSD and Bernie Paul, W5YVJ.



Houston Code Classroom.

Gordon, W1JTB, atop Mt. Washington, shows us the filament switch for his rig. Gordon was an engineer with WMTW, the TV station, at the time of my visit on Labor Day.



new completely... brilliantly new!

GONSET

COMMUNICATOR III

Now . . . a new series of VHF station "packages", linear amplifiers and accessories for amateur 2 and 6 meter bands and other VHF ranges.

The modern Communicator III model combines, in a single unit, all features found previously only in several different models. Many important, wholly new features add to even better performance and operating convenience.

- Modern inside and out. Finished in attractive Alpine White enamel with knobs in Gun Metal Blue. Cabinet size is approximately the same.
- 6V DC and 12V DC and 115V AC. All three. One vibrator. Simple interior strapping changes DC voltages.
- Full press-to-talk operation. (Actuated by button on microphone) Transmit-receive switch on panel can be used if desired.
- Receiver: New low-noise X155 RF tube in sensitive "Cascode" with AVC to avoid blocking tendency from very strong locals. Special gang-tuned circuits provide new high order of image rejection. Improved I-F selectivity. Gonset noise limiter. Adjustable squelch. Earphone provisions.
- *Full-vision slide-rule-type tuning dial.*
- Squelch for quiet standby. Control on panel.
- Transmitter: All tunable circuits now have panel knobs. New gang-tuned circuits reduce spurious emissions to negligible values. New 6L6GB modulator tube gives heavier modulation.
- Panel meter replaces "Green eye." Meter switches to exciter or RF output or to receiver for indication of relative signal level.
- Provision for 6 crystals with panel selector switch. (Also operation with external VFO.)
- Silicon diodes eliminate power supply rectifier tubes.
- New line includes Linear Amplifiers in all frequency ranges and entirely new VFO which has ranges for both 2 and 6 meters.
- 269.50 less microphone and crystals.

For further information, check number 19 on page 206.

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BURBANK, CALIFORNIA

DIVISION OF L. A. YOUNG SPRING & WIRE CORPORATION

GONSET

Across the United States the World Famous

Globe King 500B

A bandswitching transmitter for 540 watts on fone and CW; 750 watts on SSB (P.E.P.), with 10W external exciter.

Outperforming any rig in its price and wattage range the King bandswitches 10-160M in a 31x22x14¾" handsome cabinet, especially designed for TVI-suppression. The Transmitter is relay controlled; includes a built-in antenna relay; built-in VFO; and separate power supply for modulator section, allowing better overall voltage regulation . . . Commercial-type compression circuit keeps modulation at high level. King features grid-block keying for signal clarity. Pi-network matches most antennas, 52-600 ohms . . . Provisions for crystal operation.

Wired & Tested.....$725.00

FCDA Certified on factory wired and tested models for crystal controlled operation.

All WRL Electronics Transmitters operate on most CAP and MARS frequencies.

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Anchorage, Alaska

C & G Radio
Tacoma, Wash.

Northwest Electronics
Spokane, Wash.

Portland Radio
Portland, Ore.

Burghardt Radio
Watertown, S. D.

Market Radio Store
Sacramento, Calif.

Ken-els Radio
Fort Dodge, Iowa

San Francisco Radio & Supply
San Francisco, Calif.

World Radio Laboratories
Council Bluffs, Iowa

Elmar Electronics
Oakland, Calif.

Valley Electronics
Van Nuys, Calif.

Universal Distributors
Inglewood, Calif.

Radiolab
Kansas City, Mo.

Henry Radio
Los Angeles, Calif.

Valley Electronics
Burbank, Calif.

Rogers Radio
Denver, Colo.

Scott Radio Supply
Long Beach, Calif.

Dow Radio
Pasadena, Calif.

Southwest Wholesale Radio
Phoenix, Arizona

Denison Radio
Denison, Texas

Globe Champion 300

A bandswitching, 10-160M Transmitter for 350 watts CW, 275 watts fone, and 500 watts SSB (P.E.P.), with any 10W external exciter.

The single-switch bandswitching Champion is extensively TVI-suppressed, filtered and bypassed. High level Class "B" modulation is sustained without usual clipping distortion through use of a new commercial type compression circuit. Pi-network output circuit, 48-700 ohms, built-in VFO, push-to-talk, antenna changeover relay, and improved Time Sequence keying are all features. Final tubes of 400 watt power handling capacity are forced air cooled. Only 12x21⅜x17" in size, self-contained.

Kit: with wired VFO $375.00
Wired & Tested ..$449.00

Globe Scout 680

65 watts CW; 50 watts on fone, plate modulated.

A compact, self-contained, bandswitching transmitter for operation of the 6 through 80 meter bands, with built-in power supply. High level modulation is maintained. TVI-suppressed cabinet. Pi-network output on 10-80M; link-coupled on 6M, matching into low impedance beams. New type, shielded meter. Globe Scout 66 is identical, except bandswitching 10-160M. Size: 8x14x8"

Model 680
Kit.....$89.95
Wired & Tested... $109.95
Model 66
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Warren Radio
Fort Wayne, Indiana

Universal Service
Columbus, Ohio

Electronics Wholesalers
Washington, D. C.

Custom Electronics
Dayton, Ohio

Ken-els Radio
Cedar Rapids, Iowa

Meyers Electronics
Bluefield, W. V.

Castrup's Radio Supplies
Evansville, Ind.

Key Electronics
Arlington, Virginia

Radio Trade Supply
Des Moines, Iowa

Bob & Jack's
Des Moines, Iowa

Radio Equipment Co.
Norfolk, Virginia

Arcby Electronics
Louisville, Ky.

Burstein-Applebee
Kansas City, Mo

Dalton-Hege Radio
Winston-Salem, N. C.

W & W Distributing
Memphis, Tenn

Henry Radio
Butler, Mo.

Steen-Taylor Electronics
Salisbury, N. C.

Radio, Inc.
Tulsa, Okla.

Communications Center
Columbia, S. C.

Central Electronics
Dallas, Texas

James W. Clary Co.
Birmingham, Alabama

Modern Electronics
San Antonio, Texas

Radio & TV Parts Co.
San Antonio, Texas

Southern Radio
New Orleans, La.

Busacker Electronic Systems
Houston, Texas

Electronic Equipment & Engineering
Corpus Christi, Texas

Electronic Supply
Melbourne, Fla.

Kinkade Radio Supply
Tampa, Fla.

Electronic Supply
Miami, Fla.

Electronic Equipment & Engineering
Brownsville, Texas

VFO Model 755
$59.95

Universal Speech Modulator
$49.95

Code Oscillator Kit
$4.95

Antenna Tuner AT-3
$15.95

Antenna Tuner AT-4
$79.50

6 Meter Converter
$27.50

Screen Modulator Kit
$11.95

SWR Bridge
$16.95

Linear Amplifier
$124.50

Globe Chief 90

A completely bandswitching, 90 watt transmitter for 10-160M.

Here's a compact, 8x14x8", sturdy rig with well-filtered, built-in power supply. Pi-network matches most antennas from 52-600 ohms. Modified grid-block keying is employed for maximum safety. Has provisions for VFO input and operation. Kit form includes complete manual and all tubes and parts. Meter and cabinet carefully shielded for reduction of unwanted TVI.

Kit.....$54.95
Wired & Tested.....$67.50

For further information, check number 20 on page 206.

If I had written to CQ a long time ago for advice and suggestions on my problems, I might have been saved from a lot of the grief and woe that came my way all because I wanted to be a Ham. But things happened so fast and my life was one crisis after another there for a while, that about all I had time to do was anxiously scan the contents of the new CQ every month looking for articles on the particular difficulties I was having. Always to no avail. I must admit though, you did have articles on just about everything else. Hi. Anyway, eventually I did solve my problems albeit some of them the hard way, and though I am not now in need of assistance, it occurred to me there might be another hapless amateur somewhere who could profit by my experiences.

It's hard to know just where to begin, but I think March 19, 1956 could rightly be called *THE* day. The day of my first QSO and the day all of my troubles began. I suppose most of the old-timers and some jaded newcomers have forgotten that delicious thrill accompanying a first QSO. After four months of patient code practice and twice weekly twenty-mile jaunts to a code and theory class, followed by a maddening three month wait on the FCC, that precious license arrived with my very own call letters, KN6RFX.

Now during those seven and a half months, I, under the guidance of a Ham pal of mine, with eager though fumbling fingers had constructed my Novice transmitter. We used a 5763 crystal oscillator driving a single 6146 with about thirty watts output on cw, which could be modified when I passed my General and could operate 'fone. Someone once said something about 'beauty being in the eyes of the beholder.' Well this is true. For to me my rig was a very lovely thing indeed and I still cherish it. My first transmitter; even though frequently an unfeeling visitor to my shack would gasp, "What's *that?*"

Anyway, on the evening of this BIG DAY, while waiting for my Ham pal to arrive, I had turned the rig on to warm up and by the time I had chewed off most of my fingernails he came. We checked the dip and listened for a

Pictures by Bill Hawley, W6ZRZ

the Life and Hard Times of a YL Ham

Miss Myrlin V. Kirk, K6RFX

CQ to answer. Since I was nervous he told me to send out a CQ myself. I could hardly control my hand, but I took a deep breath and went to it, sending CQ interspersed with my call several times, according to the best ARRL practice. I finally signed and listened. Much to my astonishment and delight someone was actually returning my call! Before I could be sure I had his call right a loud knock was heard at my door, the telephone rang and several people in the courtyard were calling me. My neighbors, it seems, were watching the Academy Awards and I was clobbering their TV. That was all for that night.

I was off the air for a long time after that. You see, I told several Ham pals of mine what happened and they all commiserated with me and generously offered to come over and fix the trouble. Bright one Sunday they showed up for the trouble-shooting session. I thought this awfully nice of them and as I stood watching them from the window, I grew misty-eyed at this display of camaraderie, so traditional among amateurs throughout the world. How wonderful that I, too, was a member of that great and noble fraternity. Gradually this mist dispelled, as I became aware of voices being raised. Two of the group were trying to shout each other down in what was obviously a heated argument. Another began gesticulating wildly and a general bedlam resulted. I feigned a sudden disinterest in ham radio and it wasn't until they all had left that I figured out what had happened. Why hadn't someone told me that for every problem in amateur radio there are as many solutions as there are hams? Then I would have known that under no circumstances does one seek assistance from more than one ham at a time. And never, never does one ask advice of a whole group.

A week or so later, after I had recovered from this incident, with the help of ONE ham, I installed a new 40 meter dipole on the roof in place of the long wire, which, by the way, was the first of my antennas to be cut down by my neighbors. We also regrounded the transmitter and after taking every precaution we could think of, gave it another try. This time three people knocked at the door, the 'phone rang twice and only one person hollered up to me from the courtyard. Perhaps the other tenants in the building weren't home. But since I had observed all of the rules set down by the FCC, I felt that hams had to live too, so I disregarded them and happily QSO'd for a whole hour.

I consulted with my fellow hams the following day and the consensus of opinion seemed to be that because of my peculiar location there just wasn't much that could be done to clean up the TVI. I tried getting on the air only after 2200, but was informed that the best TV programs come on after 2200. They also told me that the programs are pretty good the whole 24 hours. To make matters worse, the apartment building in which I lived was somehow occupied with individuals who stayed up all night and whose only activity was watching TV. All night. They, for the most part, were aspiring movie kings and queens, artists, a ballet dancer and other odd sorts. I understand though, they all unanimously agree that the oddest one of all who ever lived there was that @$#%¢ ham in Apt. No. 8. And then as if all of that weren't enough, the building was located in the bottom of a canyon, surrounded by hills about 800′ high. This meant I was in a TV fringe area. I became adept at dodging my neighbors and somehow managed to fill a considerable portion of a log book with CW contacts.

Three months after receiving My novice license I passed the General examination. When my General ticket arrived the fun really began. I had decided to finish my homebrew and get another transmitter for 'fone operation. So one happy day I came home with a beautiful Viking II. The first time I put *that* on the air, the clamor began all over again. Only this time in earnest. It seems that not only did a KH6 copy me Q-5 40 db over, but so did my neighbors. On their TV sets, hi-fi sets, BC sets and telephones.

I called the local FCC office, requested they

Miss Kirk, how do you feel about there being so few YL Hams?

Do you prefer link coupling over the more common pi network?

send complaint forms to all of my neighbors, rechecked the grounds, installed a KW low pass filter and put up a 33' vertical with ground planes. The whole business being guyed with $12.00 worth of that new rubber-covered glass wire.

A couple of mornings later I got up especially early to see what DX I could bag. After carefully tuning the rig and loading the antenna I answered a few CQ's, put out a few myself and not getting an answer, decided to check in with an early-bird net around 7.280 mc, known affectionately as Heterodyne Alley. Even *they* didn't copy. I beeped, called 'break-in' a zillion times and at last gave it up since it was time to leave for work. I got into my car, and like every Ham that ever lived before me, turned to take a fond look at my antenna while backing out of the driveway. But there was no antenna. I stared in disbelief, jumped out of the car without even turning off the motor and made a mad dash up to the roof. There it lay. My vertical was horizontal. The coax connection was still intact, which explains why the antenna loaded, but they had chopped all of my guy wire into neat 1½" lengths. All $12.00 worth of it.

Well, I wasn't quite sure what to do. Several possibilities presented themselves. I could shoot myself. I could line all the neighbors up in the courtyard and shoot them. Without blindfolds. I could trade the rig in on a tennis racket. After much thought and consideration, and with the help of a few sympathetic fellow Hams, we put the 40 meter dipole back up. This time I imposed even more rigid 'quiet hours' on myself. But apparently the damage already had been done. I was continually getting complaints from my neighbors every time someone 10 blocks away used an electric razor, saw, vacuum cleaner and so on ad infinitum. And most of the complaints came when I wasn't even on the air!! My landlord came forth with the cheery bit of news that my rent was to be raised $10.00 a month for the privilege of having my antenna on the roof. A TV repairman informed the manager of the building that just the *presence* of my antenna on the roof would cause TVI, even if I wasn't actually transmitting. In words of one syllable I very carefully explained to them that this was impossible. But as we all know, any TV repairman knows far more than any radio amateur, especially a lady radio amateur.

Well, as I said, the dipole was put back up. This time I had what I thought was a really brilliant idea. I let it be know that there was a charge on the wires comprising the antenna and that anyone contemplating cutting THIS one down should first leave a note stating what kind of flowers they preferred so that I could relay that information to their relatives who would most likely be around in a few days to claim the body. Of course, this was nonsense, but they didn't know and all went well for a while. I think about a month. Oh, I had minor things to contend with. Like calling the telephone company to come out to install filters on several telephones in the building. The first time I called I was very fortunate in getting a service representative on the other end who knew all about these things. She thanked me

What do you talk about when Hams come to visit?

profusely for making the call myself instead of having the complaining party call and forthwith dispatched a repairman that very day to install a filter. It must have been Old Mother Bell herself because the various answers and go-round I got the next time I and some of the others called would fill a very large book. Anyway, and sure enough, one morning the dipole was down again. This time instead of cutting the wire, they burned it. Needless to say, I was more than somewhat dejected and that was the last time I had the heart to put up an antenna at that QTH.

I've had other troubles too. All in all, my year of hamming hasn't been very successful. It has been eventful though, I suppose. Like the time I went to the Motor Vehicle Department to get my Ham plates. I had an awful time convincing the clerk I really was a Ham even if I was a girl. She probably still thinks I forged my FCC license because she pulled out that big magnifying glass to look at it.

Another time I went to a jewelry store to see about getting a pair of earrings made with my call letters on them. After the clerk looked at me, down at the diagram and back up at me about a hundred times, he asked me with a puzzled look on his face. "K6RFX, what nationality is THAT?" I gave him a long talk on the 'grand old hobby,' and believe it or not, he had never heard of nor encountered a single Ham in his entire life!!!

Then there was the time I ordered my QSL cards. Now we all want to be creative and individual in our designs and since this was to be my first QSL card I was particularly anxious to have them just right. I had made innumerable calls to printers and specialty houses but no one could supply just what I wanted. I finally happened on an OM who prints cards as a hobby. His QTH was some distance from mine and so it was necessary to conduct our business by mail. Now I realize that my name looks and sounds masculine, (incidentally W6RFX handle is CARROLL and he's an OM!) but enough situations haven't occurred to make me take particular care to explain to people that I'm a female, and if we're talking in person it *isn't* necessary. Anyway, as I started to tell you, I sent off a letter to this OM with a drawing of my card. I also specified that I wanted PINK cards. Well!! I certainly should have had some warning before I received his reply. I won't quote him in full, but he said something to the effect that, "I don't know anything about PINK cards OM, they aren't easy to get OM, but you can have anything for a price OM," and in general he put across the idea that he wasn't very interested in having my business. I was a bit puzzled over his attitude because after all, he was a business man and a Ham too, and wasn't this a fine way for him to talk to a lady fellow-Ham. But after I thought about it for a while I suddenly realized that there must have been some raised eyebrows around his QTH about this OM from HOLLYWOOD sending in an order for PINK QSL's and who lived on a street named HONEY DRIVE yet. So I quickly sent off a letter to him explaining that I was a YL. Back came his letter all full of warmth and fellowship. He was obviously relieved that the ranks of amateur radio hadn't been sullied by the entrance of a Ham of dubious gender.

[*continued on page* 200]

the Supersimplescope

John W. Campbell, Jr., W2ZGU
1457 Orchard Road
Mountainside, New Jersey

Over the course of the past fifteen years, I've built, used, been dissatisfied, redesigned and rebuilt oscilloscopes about 25 times. I've got six 'scopes around the shack and shop at the moment. I've been trying, for years, to get the Perfect Ideal Wigglescope.

The specifications were a little hard to meet; in the course of hi-fi audio work, ham construction, and various oddments of electronic playing around, I needed, at various times, something that could handle dc, audio frequencies, rf, pulse waves, pips, pulsating dc, assymetrical ac waves, measure pulse voltages, and assorted you-name-it waves, and do the job dependably.

The circuitry has, at various times, gotten a little complex. Sometimes it was real good . . . while it stayed in adjustment.

Rigging an amplifier that was truly flat from dc to 5 mc is a bit tricky—but I wanted at least from dc to 30 mc. I understand the Tectronix people make one that does the job pretty well—but the $1800 job it does on the bankroll doesn't meet my specifications.

The oscillograms accompanying this piece are quite ordinary Lissajou patterns; the only peculiarity that makes them of interest is that the 1:3 and 1:4 patterns have a *ten megacycle* "Low frequency" wave. The scope has a useful bandwidth of dc to 150 megacycles—and it's flat. Furthermore, the attenuator system is perfectly flat, also. The waves shown are the grid wave of a 10 mc xtal oscillator, using a 6AK5, with 105 volt supply to plate and screen, and the plate output as a tripler or as a quadrupler. The scope does fine, too, in lining up a 48 megacycle to 144 megacycle tripler for a two meter rig.

Since it's perfectly good at dc also, it can be used as a dc voltmeter—and as a VTVM for any audio or rf voltage up to 150 megacycles. It will, unlike the standard diode-rectifier type VTVM, give you exact information on the wave-form of the voltage, and will read, with perfect accuracy, instantaneous peak voltages, either positive or negative, sine-wave ac, or pulsating dc.

It is, actually, the simplest type of VTVM you can slap together—and the whole rig cost me about eight bucks!

This, my friends, is the Supersimplescope. Since I had fifteen years of headaches with all those compensated, broad-banded, cross-corrected, super-regulated amplifier circuits—I tried going in the opposite direction. No amplifiers.

No amplifiers, of course, meant no amplifier headaches, no amplifier complications, and no amplifier limitations. The oscilloscope tube *itself* isn't bandwidth limited—it's the amplifiers that cause the trouble.

Some years back, John Pierce, at Bell Labs, showed me a lovely solution to the band-width problem in oscilloscopes. He had a set-up with a bandwidth of some 500 megacycles—by the simple expedient of building a cathode ray tube with an ultra-ultra fine-grain screen, an ultra-precise electron gun giving an ultra-sharp spot, and making the D-plates the terminations of coax lines running right into the tube itself. The deflection of the spot was minute, of course—but so what? He had a microscope mounted on the end of the tube, and the pattern was plenty big enough to see!

In effect, since no satisfactory electronic amplifier going from dc to 500 mc could be built, he'd simply used an optical amplifier—and that, of course, has no bandwidth limitations!

Bell Labs happens to be just over the hill from my home—but that doesn't mean I have Bell Labs facilities available; I can't have lovely little trick CRTubes built to my specs. But there might be another angle on this thing. . . .

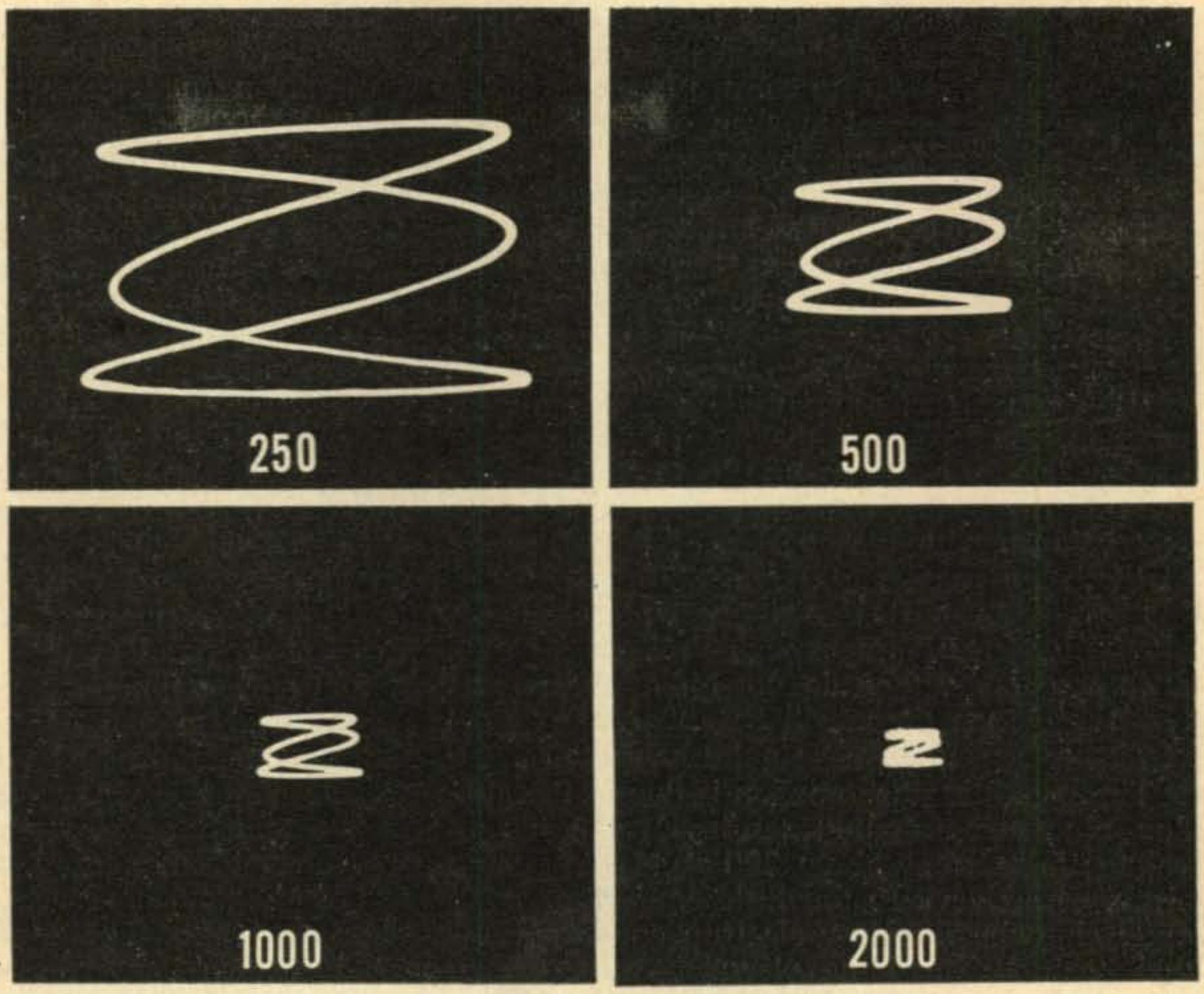
A surplus Indicator BC-929-A cost me just under $7, complete with tubes, including the 3BP1 CRTube. I stripped out everything but the CRTube, the high-voltage condenser, and the Focus and Intensity controls.

I had a hi-pot test rig, which would give me any voltage from 0 to 5000 volts dc, at about 4 milliamps. So I tried some tests.

There's a formula that shows that the deflection of the beam in a CRTube is determined by the *ratio* of the voltage applied to the deflection plates to the anode supply voltage. In a given CRTube, if the spot is deflected 1 cm by a 20 volt signal, with 1000 volts on the anode, it will be deflected 2 cm. by a 40 volt signal, if the anode voltage remains at 1000. Or 0.5 cm deflection for a 20 volt signal, and 2000 volts on the anode. Look up the figures in any of the CRT handbooks, and you'll notice they list deflection sensitivity in mm/volt at two different voltages—usually 1500 and 2000 volts for the usual CR Oscilloscope type tubes.

O.K.—if there's a 1 cm deflection at 1000 volts, what's the deflection at 200 volts on the anode? Right! Five centimeters.

But . . . only 200 volts on a cathode ray tube?!



Lissajou figure from 10 mc and 30 mc input, note change in sensitivity with anode voltage.

So it isn't conventional to use such low voltages; so what? Who ever heard of a ham being confined to using electronic gear solely the way the manufacturer had in mind! At 200 volts on the anode, a 3BP1 works very nicely indeed—and it has just 10 times the sensitivity it does at 2000 volts! A 25 volt dc potential applied to one of the vertical D plates throws the spot clear off the screen! Furthermore, the spot can be focused clear, clean, and sharp. The screen brightness is down—sure. But it is still plenty bright enough to be seen readily, so long as you don't have direct room lighting falling on the screen itself—it's about like the picture on a standard TV screen: you can see it perfectly. The fact that a 3BP1 gives a green trace, of course, helps to make it sharply visible, too; room light is white, not green, which raises the effective contrast.

The exposures for the accompanying oscillograms were made at about f6, for 1 second, on Tri-X pan film, which will give the photographically minded some indication of the brightness. ("About" f6 because I used a camera with double-extension bellows, extended all the way, opened to f4.5, which makes the exact f-ratio something of a question. Incidentally—a side note for photographic hams: the best gimmick I know of for getting good oscillograms is an old, cheap clumsy camera —with a double extension bellows. I use an old Zeiss Ikon Maximar 9 x 12 cm job, with a 2¼ x 2¼ roll-film back that takes regular 120 film. I get a negative image that's about 80% of the actual size of the trace pattern on the 3BP1. And I have ground-glass focussing to make sure I get things really sharp, and just where I want 'em. The camera cost me $18, looks rather shabby, but works perfectly.)

Tests using the variable voltage supply showed that the thing worked, would give a good, sharp, adequately bright spot anywhere from about 200 volts up to the full rated maximum of 2500 volts. At the low voltages, the Intensity control is wide open, and Focus is adjusted; the spot will stay in focus over a wide range of voltages, because focus is determined by the *ratio* of voltages, not by the voltage-as-such.

Below 200 volts, the spot will abruptly wink out of existence unpredictably. If the voltage is slowly raised, the spot does not at first reappear; instead a bright green ring, surrounding a black area of irregular shape will appear. If a signal was being applied when the wink-out occurred, the signal will show normally on part of the screen, but there will be an irregular area-of-avoidance, where the signal refuses to show.

The reason for this is interesting, and relatively few electronics engineers are aware of the phenomena involved.

A cathode ray beam is, of course, a stream of electrons; the spot of fluoresence on the tube face is caused by the impact of these electrons. But . . . electrons are negatively charged particles; the glass face of the tube-end is, in the hard vacuum of the CRTube, a magnificent insulator. Where do these charged particles go after hitting the tube end? How

do they *leave* the spot where they hit? Leakage across 1½ inches of high-quality glass, in a hard vacuum, is far too low for electrons in the quantity involved in even so weak a current as the cathode ray beam.

The answer is that the electrons hit with considerable velocity—hit hard enough to cause secondary electron emission. One electron hits —and knocks off one or two "chips" from the atoms it hits. These knocked-loose electrons are attracted to the relatively positive potential of the graphite coating inside the rest of the cathode ray tube, and the flight of these secondary electrons *from* the point where the cathode ray beam is striking will reach a perfect balance with the charges of the electrons of the beam coming *to* the spot.

Provided, that is, that the arriving electrons hit the tube-end hard enough to cause secondary emission. If they do not hit hard enough, of course, then there will be an accumulation of negative charge at the point of impact.

The wink-out phenomenon is due to the flip-flop type response that results. If the beam-voltage falls below about 200 volts, the beam-electrons arrive with too little energy to cause quite enough secondary electron emission. Say that each 100 arriving electrons cause, as a statistical average, 99 secondary electron emissions. There will, then, be a slow accumulation of negative charge at the spot.

But the presence of negative charges acts to repel arriving electrons; this slows them down so that they arrive with less energy. But since they are arriving with less energy, instead of an average secondary emission of 99, the secondaries drop, say, to 80. This makes the negative charge rise faster, the repulsion increases, the beam electrons arrive with even less energy, there's less secondary emission, so more negative charge . . . and in some very minute fraction of a microsecond, the beam winks out. The negative charge on the tube-face has become so high that the beam is simply deflected away from that area; there's an invisible dome of negative electrostatic field that deflects the stream of electrons away.

The result is a bright green circle (where the deflected electrons can arrive) around the dark, irregular area, where the negative charge is too great to allow impact.

If you want some fun, cut the voltage down to about 50 volts, in total darkness, then *gradually* run the voltage back up to about 200. You'll get a wierd and beautiful "total solar eclipse" picture, with a green ring of brightness immediately around the black, central area, and slow, wavering streamers of green luminescence streaking off radially in all directions. If the Focus control is thrown all the way out of focus, the effect is quite startling and will cause ham-shack visitors to do far more oh-ing and ah-ing than your finest DX cards.

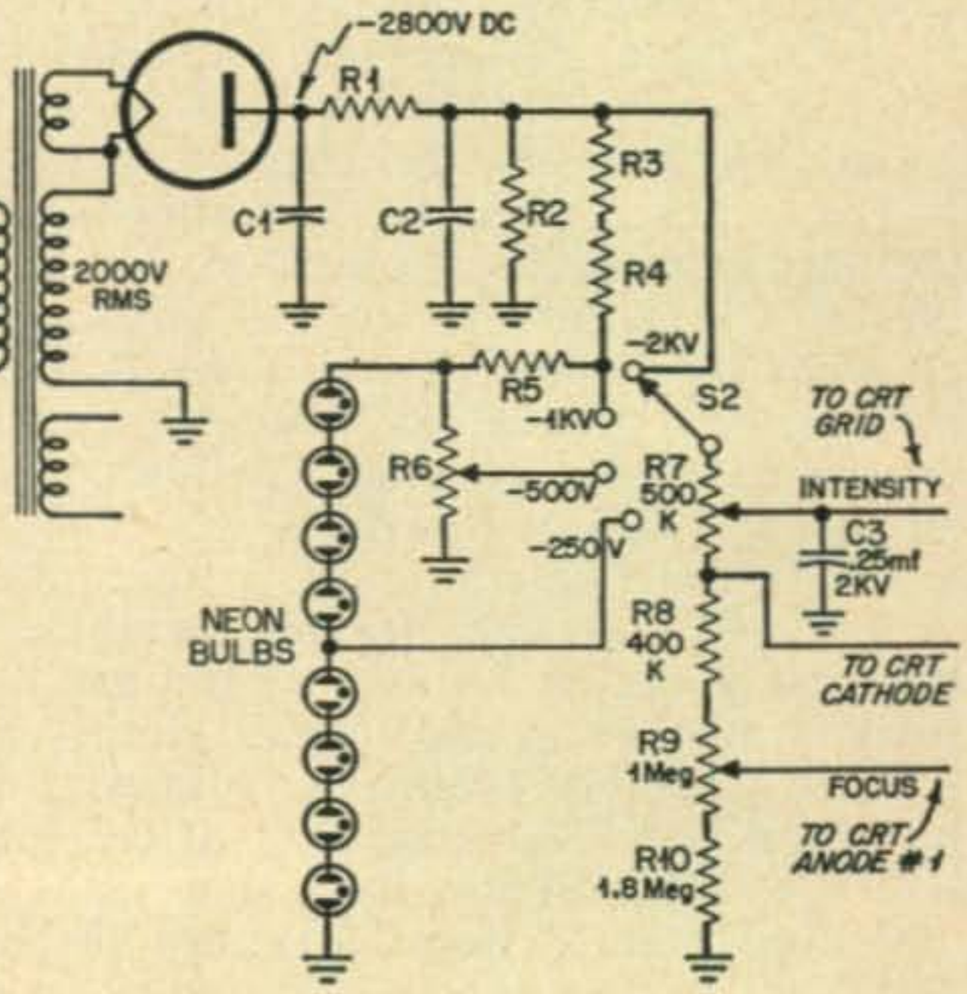
However, if you keep the voltage on the anode above 200 or 250—depending on your particular 3BP1—the spot will behave in a perfectly normal manner.

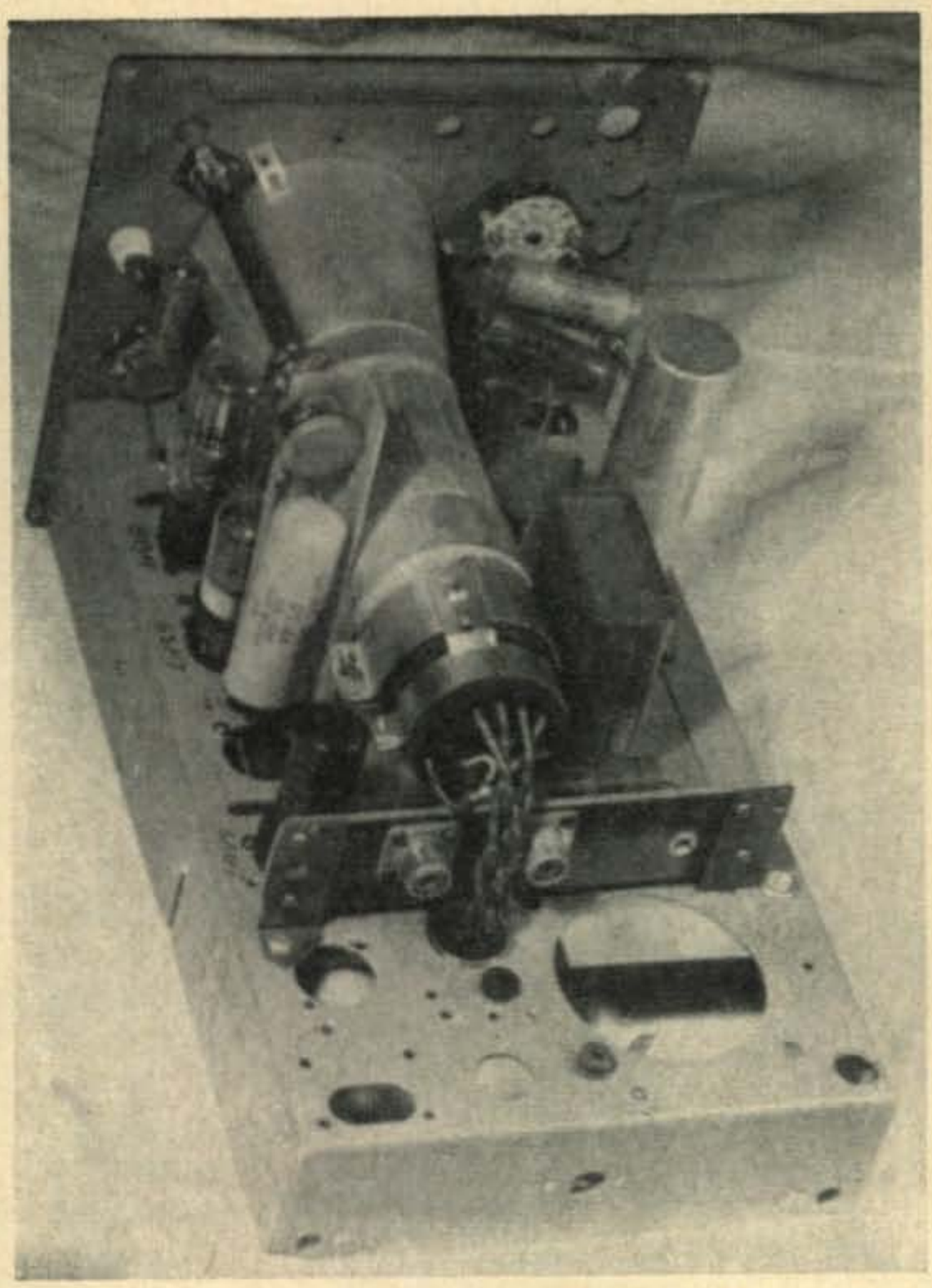
With 200 or so volts on the anodes, the deflection sensitivity is such that a 5-volt-peak signal—10 volts peak-to-peak—gives a deflection of over an inch. That's plenty adequate deflection for any real use you'll have for a pattern on the scope—for studying wave-forms, or checking the multiplication ratio in a frequency multiplier. (The final, ultimate, no-question-about-it answer to the ever-recurrent problem "Is this the 3rd harmonic I want, or the 2nd or 4th that I don't want? Is the blasted thing tripling, or doubling . . . or maybe quadrupling?" One glance at the Lissajou pattern on the scope, and you'll *know*. And this gimmick works, remember, right on out through the 2-meter band!)

Since deflection is determined by the *ratio* of anode voltage to signal voltage, varying the anode voltage gives us a means of varying the deflection. One of the really rugged problems in wide-band oscilloscope design is, and always has been, getting an attenuator that is truly flat—that attenuates dc and rf in exactly the same ratio. The professional oscilloscope designers tear their hair over that one.

Hah! We can duck it completely! Instead of trying to change the amplitude of the signal —we change the sensitivity of the tube! If the deflection pattern is too big—run up the anode voltage on the scope tube! No attenuator problem at all, since we're handling pure dc when we manipulate that anode voltage.

With a *fixed* anode voltage, the deflection of the spot is rigidly determined by the signal voltage applied. Then all we need to produce a perfect ac-dc-rf vacuum-tube voltmeter is to apply a fixed anode voltage, and calibrate the deflection of the spot on dc, which we can measure accurately and easily. The deflection will be exactly the same for an equal peak voltage, whether it's pulsating dc, audio fre-





Rear view of the modified BC-929A. Sawtooth oscillator circuit can be seen along the left side of the chassis.

quency, or way-up-in-the-megacycles rf.

The face of the 3BP1 then becomes equivalent to that of a 3-inch voltmeter having a zero-center scale. If you want a left-hand-end zero, simply apply dc bias enough to move the spot over to one side. You can read the spot-position on the 3BP1 face just about as accurately, actually, as you can the needle-position on a standard 3-inch meter. Only with this type of meter, when you say "I measured it!," you'll come a darned sight closer to knowing exactly what you measured! This one will give honest answers on *any* type of electrical voltage between dc and 150 mc.

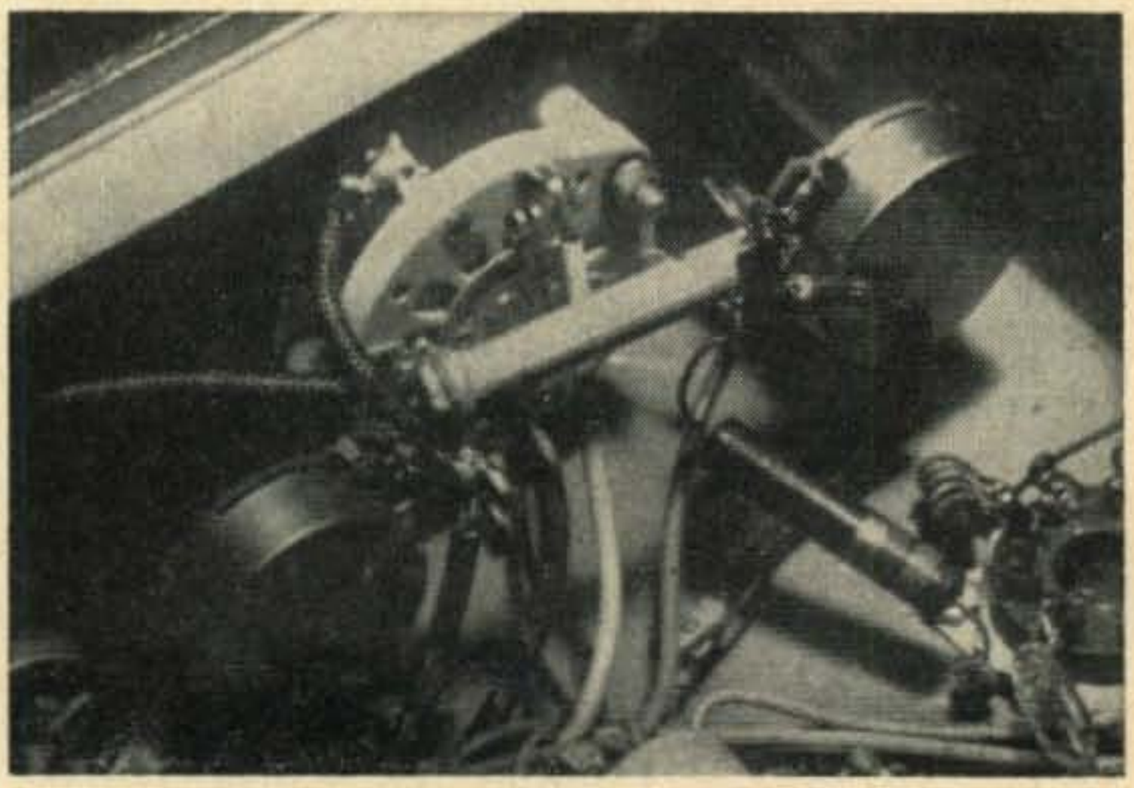
With 200 volts on the anodes, it takes about 20 volts to get deflection from center to extreme side. With 2000 volts on the anode, it takes about 200 volts peak. You can "change scales" on your CRT VTVM, then, by simply changing anode voltage.

At first thought, the deflection sensitivity of this Supersimplescope system may seem too low to be practical. Try some second thoughts; a 3-volt signal is very readily read on the screen. Sure, it's small—but so's a 4-40 bolt, and they're useful. So are the individual letters in the type on this page, but you can read this easily enough. If you insist on big patterns—O.K., but you need a big bankroll to go with that insistence. Then you can buy a Tectronix scope. Of course, even the Tectronix job won't handle the two-meter band, as this Supersimplescope will.

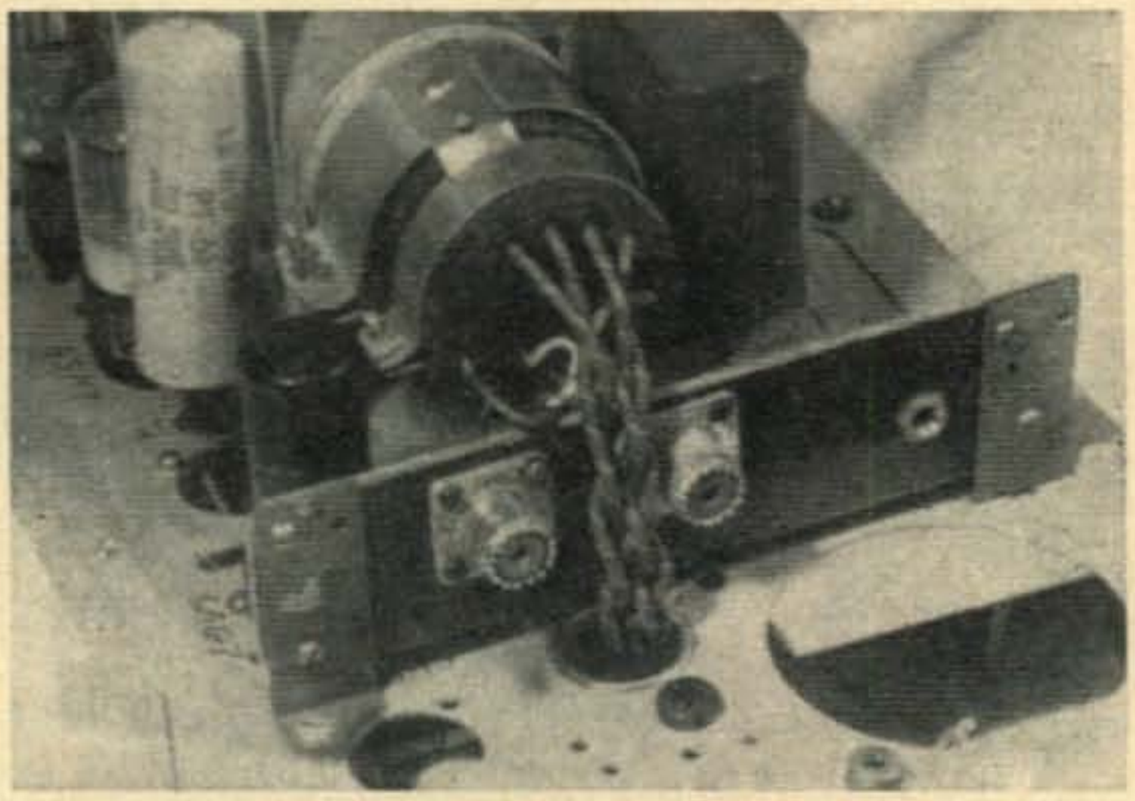
Again, if you insist on big patterns—remember that a magnifying glass is cheaper, by a darned sight, than even a simple amplifier system—and has no band width limitations.

But the most important item for your consideration is this: darned few laboratories, even, bother to have VTVM's or even dc voltmeters with scales below about 0-3 volts. Sure, there are a number of millivoltmeters and even microvoltmeters available—but how many people have any actual, real use for 'em? If you've been able to struggle along with 0-3 volt scales on VTVM's and Multimeters—maybe you don't, actually, *need* millivolt sensitivity in your scope after all, huh? Practically all the actual use of a scope around the shack turns out to be in the volts to hundreds of volts range. Notice that the little 6AK5, acting as a quadrupling crystal oscillator, with only 105 volts on the plate, produces signal enough to swing the spot of the Supersimplescope high, wide and handsome.

Agreed, it would be fun to have high sensitivity, simplicity, and broad band. But actual operational use showed me that I didn't *need*



Centralab voltage selector switch mounted between the focus and intensity controls.



Direct feed connectors to get rf right into the deflecting plates with a minimum of losses.

it. I've got a scope set-up that's got an input sensitivity of about 0.1 millivolt, and a bandwidth of 5 megacycles. I've used the full capability of the thing just once, after I got through with the tests to prove that it would do it.

The gadget, as I now have it rigged, will do all the normal shop work—and do it far better than the other scopes that cost me a lot more in cash money, and time invested. Sooner or later some manufacturer will catch on to the possibilities of this approach, and bring out a nice, simple, compact, and cheap Supersimplescope commercially—because it's perfect for servicing color TV systems, as well as practically all ham and general radio gear.

After the tests with the hi-pot system had shown what could be done, I went to work on the set-up. I had a 2000 volt CR Oscilloscope power supply already on hand, with a regulated 400 volt power supply for the auxiliary circuits, so I used that.

Calibration

With a fixed anode voltage, you can calibrate the scope for accurate voltage readings—so I want a regulated high-negative-voltage supply. The solution is easy—a string of those smallest neon glow tubes. Each one maintains, quite accurately, whatever voltage it happens to work at; different tubes work at from about 55 to 70 volts, but whatever voltage one of 'em picks, it sticks to very nicely. A string of 5 in series, gives you roughly 250 to 300 volts—but whatever it comes out, it'll stay there very reliably.

Centralab makes a "ham switch" that's rated up to 1500 volts at considerable power. With practically zero power—the few milliamps of a cathode ray tube circuit—it will handle 2000 volts nicely.

The Allen-Bradley type potentiometers will take 500 volts to ground.

The final power supply set-up uses one of the "ham switches" to tap off the full 2000 volts direct, 1000 volts, and neon-tube-string regulated voltages of 500 and 250. The 500 volts is fed through a potentiometer, so that I can get either the 500 volts regulated for voltmeter use of the scope, or adjust the anode voltage from 500 down to 0 volts. The 250 volts regulated gives me my maximum sensitivity voltmeter scale.

The elegant way of doing the job is, of course, to use a variac type control on the primary of the high-voltage transformer, so you have smooth control from 2000 down to 0 volts. This requires, however, that you use separate hi-voltage and rectifier-and-CRT-filament transformers. Nice, but not cheap.

By switching the anode voltage, I can change the pattern size, each successive step of the switch doubling the deflection on the screen. The accompanying oscillograms show what happens to a given pattern on the screen when you go from 250 volts to 2000 volts. The *linear* dimensions are decreased by a factor of 8, but the *area* of the pattern is decreased by a factor of 64 times.

In the photographs of the rig, the sawtooth deflection system can be seen along one side. It's good from about 15 cps to around 100,000 cps.

A built-in sawtooth generator isn't necessary, of course; a lot of the uses of a scope don't require it, but it comes in handy at times.

The deflection plates of the 3BP1 are brought out as directly as possible to standard coax fittings mounted on the fiber-bakelite mounting strip; the strip should be as close to the base of the 3BP1 as possible, to keep the lead-lengths down. Coax fittings allow you to plug in standard coax, of course, and also accept standard banana plugs.

The sawtooth oscillator output is brought out to a pin-jack, and when it is to be used, a short jumper is run from the pin-jack to the horizontal input. Reason: for maximum rf response, let's not louse things up by putting a switch in the circuit.

In wiring up the 3BP1, for maximum simplicity of circuit, I decided to leave out the vertical and horizontal centering controls. The surplus 929-A has a mu-metal shield around the 3BP1; it may not be technically proper to do magnetic tricks to a mu-metal shield, but I exercised my ham right to make it do what I wanted, not what the manufacturer intended. A slight application of a permanent magnet, and the mu-metal shield can be made to act as a magnetic vertical and horizontal centering control.

The Focus and Intensity controls were left in place. You might have to change the resistor string slightly to get the Focus control in the desired range for your particular tube when running in the low-voltage range, but that's simple cut-and-try stuff.

Controls

The scope tube itself, then, has four controls: Intensity, Focus, Voltage Selector switch, and the Voltage otentiometer. The Voltage Selector and/or the Voltage Pot act as the attenuator system, without in any way affecting the input signal itself. The one disadvantage of the system of changing the CRTube's deflection sensitivity, instead of trying to attenuate the input signal, is that *both* horizontal and vertical signals are affected simultaneously. Both horizontal and vertical deflection sensitivity change when the anode voltage is changed.

When the sawtooth sweep is used, if I want to "attenuate" the vertical deflection (decrease the 3BP1's deflection sensitivity) I simply crank up the gain on the sweep amplifier to compensate.

In lining up a frequency multiplier, that system couldn't be used, of course—but normally the voltage applied to the grid of a frequency

multiplier is of approximately the same order as the voltage output at the multiplied frequency—as in the case of the accompanying oscillograms, where the 6AK5's grid signal is not vastly different in magnitude from the 4th harmonic output.

The input capacity of the deflection plates of the 3BP1 differs markedly; for handling high radio frequencies it makes a difference which ones you bring out as the driven deflection plate. One of each pair will be grounded; the other is used as the input.

The horizontal deflection plates (lower sensitivity) are DJ1 and DJ2—Pins 11 and 10 respectively. The vertical deflection plates are DJ3 and DJ4—pins 7 and 8 respectively.

DJ3 has an input capacitance of 6 mmfd—which compares favorably with that of the usual VTVM, you notice!—when all other electrodes are at rf ground. DJ4, its team-mate, has an 8 mmfd capacitance—so ground DJ4 (Pin 8) and make DV3(Pin 7) the vertical input.

DJ2 has a 7 mmfd input capacitance, and DJ1, its team-mate, an 8 mmfd capacitance. There's no great choice here, but you might as well use DJ2(Pin 10) as your input, and ground DJ1(Pin 11).

The Indicator 929-A has somewhat of a Swiss-cheese effect, when stripped for action; there's quite a few holes punched through the front panel and the chassis. Your resultant Supersimplescope may not suit you perfectly so far as looks go; you can build a new chassis if that's important to you.

But you'll find practically all the parts you need, except for the power transformer, and an extra high-voltage condenser. The BC-929-A was designed, unfortunately, for 400 cycle power supply; that's one of the main reasons it's so cheap.

But, Swiss-cheesey looking or not, this no-amplifier, low-voltage scope set-up will outperform, in practical applications, anything I've seen so far—including, for 99% of practical applications, that $1800 job!

Notes:

The high-voltage transformer should yield 2000 volts RMS, in order to assure the full 2000 volts for the CRT after filtering. C1 & C2 should be .5 to 1.0 mfd 3000 volt condensers; surplus units of this rating are available. The high-voltage transformers are also available in surplus; the rectifier tube and winding aren't specified, because there are a number of rectifiers that can handle the voltage available now. Which one you choose depends on what's handy in surplus. All the windings in the hi-volts transformer should have a 3000-or-higher test rating.

R1 should be about .5 meg, and R2 adjusted by trial-and-error (but look out for them 3000 jolts while you're doing it!) to yield 2000 volts at the CRT. The R1-R2 serves three functions then: R1 acts as the filter-resistor, R2 is the bleeder resistor, and the R1-R2 combination is the voltage-dividing system to yield 2000 volts. R1 should be a ½-watt job, but R2 should be made up of a series of ½-watt, 500K units totaling about 2 megs or better.

The accuracy of calibration of the Supersimplescope as a voltmeter depends on the accuracy of the anode voltage supply, since deflection is a function of the ratio of signal-to-anode voltage. The neon bulb string gives stabilized voltages at 250 and 500 volts; the higher ranges do not, in practical work, need to be stabilized so carefully.

If you want to be able to switch voltage ranges, however, the ratio of the voltage-taps must be accurate. That is, if a certain calibrated point means 10 volts, with 250 volts on the anode, then it will mean exactly 5, if the anode voltage is made exactly 2 x 250, or 500. And it will be 2.5 volts at exactly 1000 anode volts, and 1.25 volts with exactly 2000 on the anode. R3, R4, and R5 should be about *350K ohms each, but these, too, should be calibrated by trial-and-error, measuring the actual voltages at the input to the CRT control system—i.e., at the top of R7—with the scope control system draws some current.*

The 500 and 250 volt range will be determined by the neon bulbs selected. They vary between about 55 and 70 volts, from one to another—but each holds its own voltage stably. Select ones that total the voltage you want.

R6 should be a 1meg pot; the Allen-Bradley type is strongly recommended; they'll keep working with reasonable dc through them, and are insulated for 500 volts to ground.

R7 and R9 are already in the BC-929-A indicator; they're the FOCUS and INTENSITY pots already present, and correctly insulated for the high voltage. R8 is a ½-watt, and R10 a 1-watt carbon resistor.

C3 and C4 are the two sections of the high voltage condenser already present in the BC-929-A.

I prefer a power-pack on a separate chassis for CRT work; a connecting cable is simple, and that gets the hum-field of the 60-cycle transformer away from the highly sensitive cathode ray beam—which is really sensitive to hum on that 250 volt anode setting. Any of the standard sawtooth sweep circuits can be used, either built in, or on a separate small chassis.

S2, as mentioned in the text, is a Centralab Ham Switch; rated voltage is 1500 at 100 watts, but it works happily at 2000 with this miniscule power load.

Finally, stump your electronics expert friends! If they're darned fools enough to fail to read CQ, *it's a safe bet they won't be able to explain that Total Eclipse of the Sun effect mentioned in the text!* ■

drawn finish

RTTY

the easy way or a word to the wise ow....

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West Trenton, New Jersey

This story is true, only the facts have been altered to protect the guilty.

The operator sat at his desk idly tuning the 75A4 across the cw portion of the 20 meter band. Suddenly there was heard the blip-blop-blip-blip of an RTTY signal. He tuned it a little sharper, lowered the volume until the signal was barely audible and then pushed several buttons on a panel nearby. A solid click was heard like a 15 ampere relay closing, on another panel the needle of a zero center meter started to swing back and forth each side of zero, a few seconds later a plus sign appeared on a large cathode tube screen. The operator casually glanced at all the evidences of a satisfactorily transmitted and well tuned signal and then facing a patch panel, selecting several cords he plugged in and flipped a small switch. Soon the staccato sound of a teleprinter was filling the room. I went to look. Amazing! Simply amazing! Here was plain text perfectly readable: "ok on your biased framis but I prefer to use the unbiased Fourrier hi hi . . ." This went on for some time until the sender indicated that he had a message to be relayed. The operator gave the Go Ahead signal. Another cord was plugged in and another switch flipped. This resulted in a quite different sound. In addition to the teleprinter we added the hum of another motor and a series of irregular taps like those of a jeweler's hammer on a small anvil. I glanced toward the far corner of the room and

there saw a square box out of which a ribbon of paper was paying out and curling up on the floor. It looked like paper lace work. I was too impressed to move. After the message had been copied in print and put on tape the machine was unplugged and the motor shut off. While the operator was going through the formalities of closing down, I gathered my wits about me and went toward the tape punching machine to inspect the tape. It looked like a heavy grade, soft surfaced paper with a number of fine holes some small and some larger. The small ones all ran in one line along the length of the tape while the larger ones were irregularly spaced. The operator came over to the machine, picked up the length of tape and said something about reprinting and checking for errors. He slipped the end of the tape in a contraption located in the end of another box, plugged in a cord, threw a switch and the tape began to go through the box in a series of short, quick movements. As if by magic the printer reproduced the same message text that had been sent previously. There were no errors so the tape was removed and hung on a coat hook on the wall. The operator said something about putting it on a net tomorrow. The next step was a guided tour through the station during which words like band-pass filter, mark and space filter, discriminators, polar relays, toroids, limiters, Schmidt trigger, coincidence selector and flip-flop were thrown about in the most casual manner. I smiled bravely and tried to bow out before it became apparent to the operator that he had been wasting his time talking to the most ignorant amateur this side of the Mississippi. Murmuring something about Gates, W2PAT, CFA, Type 152 and pressing a bulletin in my hand he bade me goodnight, hoped I would return soon and wished me the best of luck.

The fresh air felt good and steadied me. On the way back home I toyed with the idea of going RTTY myself, alternately accepting and rejecting the idea. The state in which I found myself, confused and overwhelmed, was hardly a suitable one for making decisions, but the seed had been planted in what turned out to be fertile ground.

The Fatal Step

There is little need to go on and tell how the decision was finally reached, but one morning the fatal step was taken and ground work begun toward the acquisition of a machine. I don't know why a machine should have been the first item, one has to start somewhere, and the machine is certainly the most impressive piece of equipment. I scanned the advertisements in the back issues of THE radio magazines and eventually located a printer described in the most glowing terms, complete with table, motors, switches and cables. The price seemed a bit steep, but considering what it cost originally did not appear out of line. The check was duly mailed and after explaining to the other member of the household that no home should be without one of these things, I settled down to waiting. One day, a call from the local Express Office informed me that two packages were at the railroad depot and that upon payment of $17.65 they would be mine. Little time was lost in getting there, and emptying my pockets of all available cash, I went to the loading platform to claim my property. With the help of two Express employees I managed somehow to get the two huge television tube cartons in the car, and with the rear springs sagging I drove home. With the assistance of some kind-hearted neighbors, I got the cartons in the living room, and then by subterfuge, I managed to clear everyone out of the house. I wanted to be alone at the "opening." This treat was to be reserved for my eyes alone, partly out of selfishness, but also partly due to the desire not to be humiliated should the packaged contents fall far short of my expectations. I tackled the table first. After pulling out a mountain of balled paper I got the table standing on its own legs in the middle of the living room. It was metal, in need of much paint. The front legs had more holes drilled into them than a swiss cheese and I wondered if they would support the weight of the table, not to mention the weight of the machine on top of that. Philosophically I decided that the table could be repainted and the legs strengthened. Next came the machine. Another heap of last year's newspapers and there it was. Somehow it did not look like the one I had seen at the Operator's shack. It must be a different model, but naturally much better since it was heavier and undoubtedly more expensive. The thing weighed a ton, or so it seemed, but I got it on the table and began to admire, then inspect and then complain. The cover had a pane of glass and this was cracked. It was replaceable. The cover needed painting as well as having some dents removed. I removed this cover after some fifteen minutes of struggling, and one glance made me doubly glad that the wife was not in the room. One look at the oily mess and she would have had me lug it immediately to the basement or to the garage. However, I had another look before she returned. There were two motors and I saw a cable with a plug on the end. This must be the AC cord. We might just try this and see if it turns over. Let's check again. Then the roof fell in. They were DC governed motors with little white stripes on the fan. Well, that was that. The cover went back on the machine and I sank into an easy chair wondering whether I should throw the clunker down the cellar steps now or break it up with an axe. I could explain to the XYL that it was an accident. I didn't dare to look the machine over again for fear of finding even greater

[*Continued on page* 170]

This article not for sidebanders

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Grounded Grid Exciters

Much has been written about grounded grid r-f amplifiers for both class C and class B linear service, but not much has been said about the possibilities for use in exciters as frequency multipliers. An experimental exciter with four 6AG7 tubes connected as grounded grid tubes was set up for the 3.5 to 21 mc bands for connection to a low powered VFO unit previously used on these bands to drive a 4X-150A final amplifier.

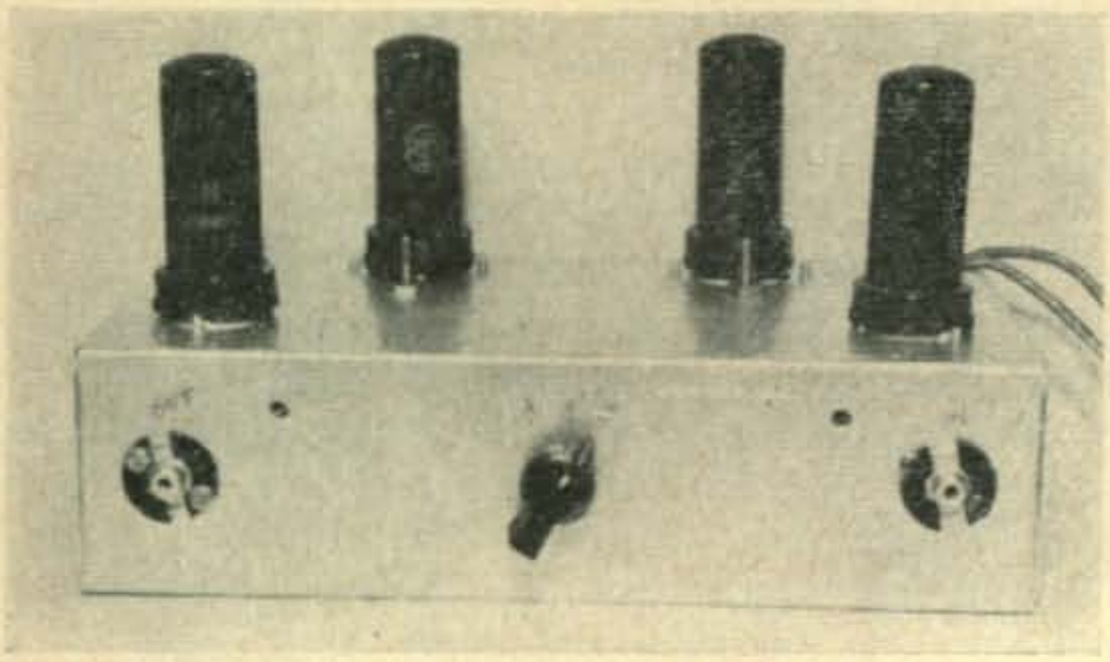
Any small receiving pentode may be used providing the suppressor grid comes out to a separate pin connection from the cathode. In any grounded grid amplifier, the capacity from the driven cathode to the plate circuit should be as low as possible so all grids should connect to r-f ground either directly or thru by-pass condensers. In a frequency doubler this capacity isn't as important, though many a frequency doubler has taken off as an oscillator when this capacity in the tube between the input and output electrodes is a little too great.

Tubes such as a 6AU6 or 6BA6 can be used as grounded grid high mu triodes for very low powered stages. Power tubes such as a 6CL6, 12BY7, or 6AG7 are better due to more power handling abilities and higher transconductance. A tube with very high G_m takes less grid or cathrode drive to produce output on the second or third harmonic than a lower G_m type.

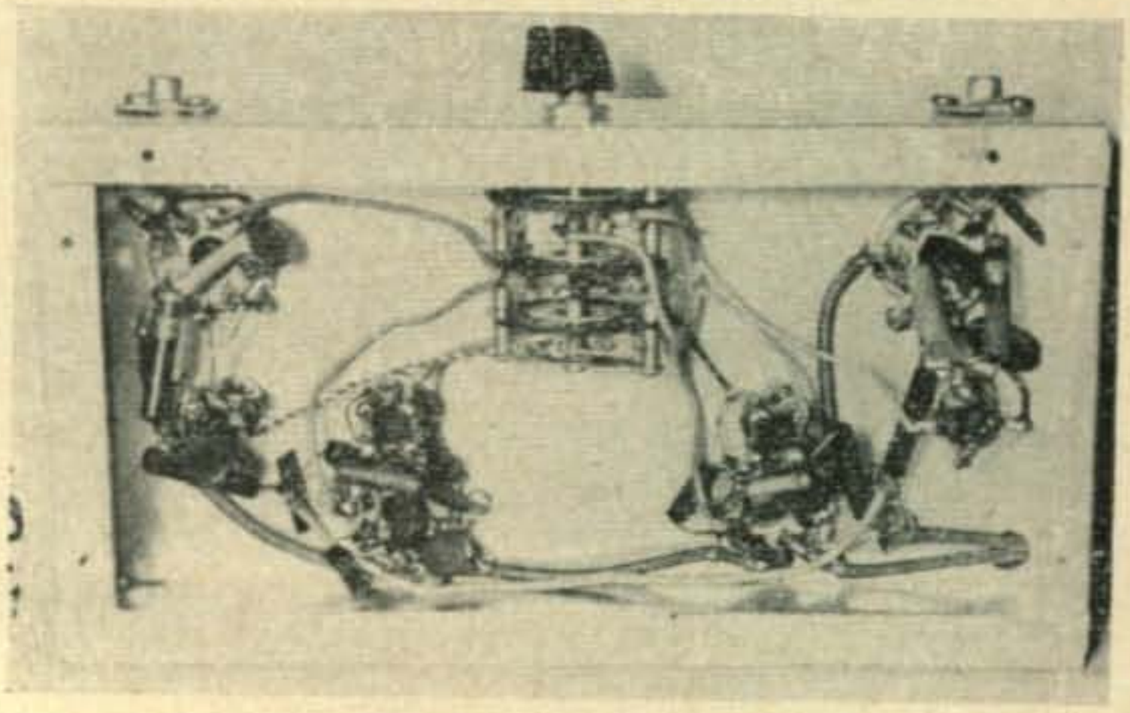
A type 6AG7 power tube or its 9 pin miniature cousins, the 6CL6 or 12BY7, can be used as a grounded grid triode with all grids grounded if enough cathode drive is available to drive it well into the Class B region. If enough drive is available to operate it into the Class C region, grid leak bias on number 1 grid (normal input grid) is necessary to prevent overloading this grid since it will not stand as much dissipation as the screen and suppressor grids. These grids all have current flowing thru them to ground and back to cathode in a grounded grid amplifier or frequency multiplier unless the tube is operated in Class A service.

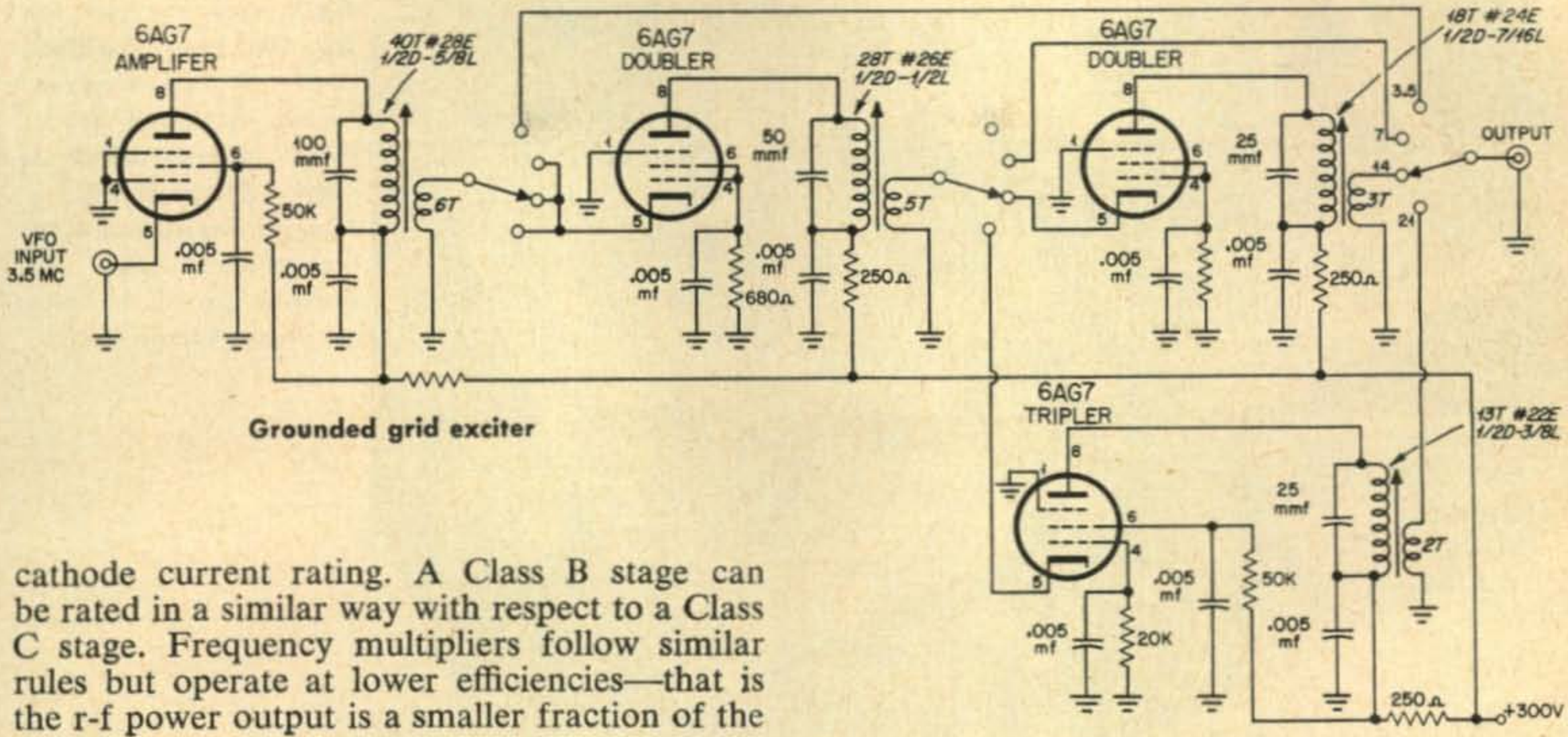
In the experimental cathode driven or grounded grid exciter illustrated here, about 4 volts peak, or less than ¼ watt was available from the VFO unit thru a 70 ohm co-ax line. This was not enough to drive a 6AG7 tube with the grids all directly grounded so the power sensitivity was increased by having a positive voltage on grid number 2, screen grid, with a 50,000 ohm resistor to the 300 volt plate supply and a suitable by pass condenser to ground. A Class A amplifier has greater power sensitivity than a Class B stage, but will not have as much power output for a given plate dissipation or

Completed exciter



Underchassis view





Grounded grid exciter

cathode current rating. A Class B stage can be rated in a similar way with respect to a Class C stage. Frequency multipliers follow similar rules but operate at lower efficiencies—that is the r-f power output is a smaller fraction of the d-c plate power input.

Cathode driven frequency multipliers offer some advantages for simplified output switching in a multiband exciter since the cathode impedance of a high G_m tube is not much greater than the usual link coupling impedance of 70 ohms or so used between stages of a transmitter. Some compromise is necessary in the output winding of the tuned circuits in order to use it as either a link coupling to the final amplifier or to drive the next frequency doubler or tripler. However, this type of circuit design eliminates circuit detuning present with capacity coupling, and gets away from the need of an extra tuned circuit between each stage where high input impedances are involved such as in a grid driven amplifier or doubler. The normal cathode impedance of a 6AG7 or similar tube ranges from about 100 to 300 ohms depending upon the class of operation and amount of driving power available.

As previously mentioned, some grid leak bias on grid number 1, or 1 and 2, is advisable when a fair amount of cathode drive is available. In the frequency doublers going from 3.5 to 7 mc and from 7 to 14 mc a grid resistor by-passed to ground of 600 or 700 ohms reduced the d-c plate current without any loss of r-f output power. Even higher grid leak values would be needed if a 400 or 500 volt plate supply was to be used. The insulation and design of the 6AG7 and 6CL6 is such that in grounded grid service, 600 or 750 volt supplies can be used if high r-f output is needed. It is advisable to keep the plate current to values less than 30 ma., particularly at higher d-c plate voltages under the full cathode drive conditions. The grid number 1 resistor to ground can be of such a value between zero and 25,000 ohms to permit using any available plate supply between 250 and 750 volts. With over 300 volts, the series screen resistors have to be larger than those used in this exciter and some experimenting would be necessary. These resistors of 50,000 ohms in the first tube, a 3.5 mc amplifier, and the 7 to 21 mc tripler are suitable for a 300 volt supply. The frequency tripler gave twice as much output for a given cathode drive when the grid number 2 (screen grid) was made positive as shown in the circuit diagram.

Power Output

The measured output in a 75 ohm resistor was 1 watt in 3.5 mc c-w band, 1 watt in the 7 mc band, 2 watts in the 14 mc band, and 2.5 watts in the 21 mc band. The power increase with frequency was necessary to take care of higher circuit losses in the final amplifier tube and its grid circuit coils. Another 6AG7 tube as a frequency doubler from 14 to 28 mc could be added by adding another switch section ahead of the output jack switch. This doubler should be similar to the tripler stage except for its plate coil and condenser which would have to be tuned into the 29 mc band.

This experimental exciter was built with small surplus iron-cored slug-tuned coils and tubular shunt tuning condensers to primarily study the possibilities of cathode driven or grounded grid amplifiers and doublers or triplers. If higher output than 1 or 2 watts is desired, the condensers should be of the variable air dielectric type with larger fixed inductance coils of the types used in larger multiband exciters. Likewise, a ceramic insulated band switch would be necessary and a larger output co-ax fitting of the type for RGU-58 or -59 co-ax line would handle several watts of r-f power without heating losses or breakdown. The phone-plug jacks and iron slug coils used in this exciter should not be considered where higher outputs and over 300 volts are to be employed. ■

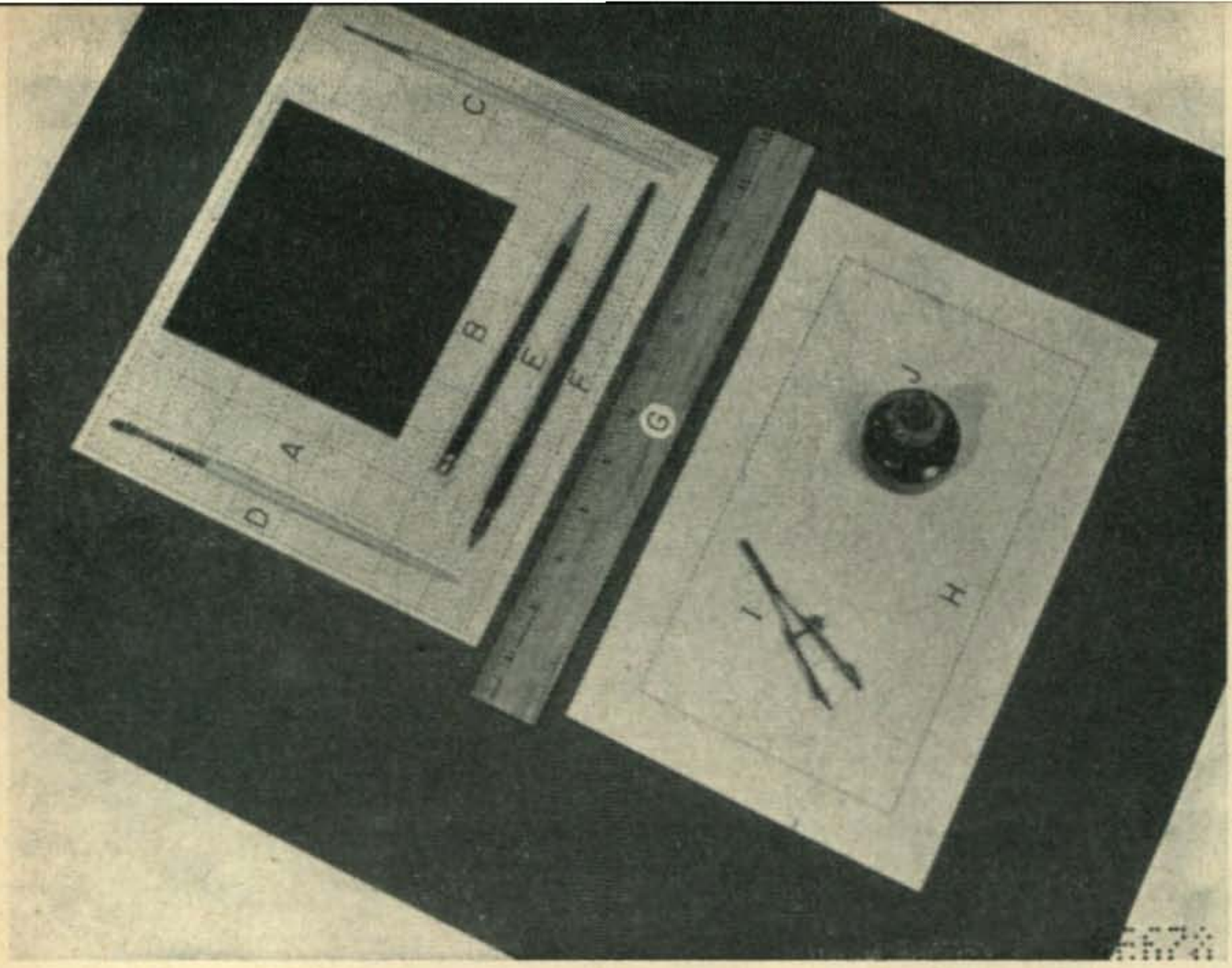


Fig 3. Tools required for QSL designing. A—Block paper, B—Carbon paper, C—No. 1 artist brush, D—No. 4 artist brush, E—No. 6H hard pencil, F—Straight pen, G—ruler, H—Strathmore No. 74 drawing board, I—Compass, J—India ink.

Designing QSL's at Home

F. D. Whitmore, W2AAA
223 W. Holly Ave.
Pitman, N. J.

Would you like to make your own QSL designs?

Creating dynamic QSL designs is easy if a few basic art procedures are followed. But first, you must step across the threshold from type format to printing plates. Once you make this step, you are halfway toward your goal. No longer need staid type faces with their restrictive space requirements be tolerated. You are free to explore limitless designs and obtain individualism for yourself and your station.

With only a little effort and adherence to some simple rules of art, sparkling homemade designs evolve. Cards take on a third dimension; they come to life and radiate the personality of your station.

You'll enjoy the thrill of doing it yourself. Besides pride of accomplishment as your pet design materializes, a big saving is realized—the artist's cost is eliminated. Removal of the art cost eliminates the largest cost associated with QSL printing plates bringing plate printing techniques within the financial reach of practically everyone.

Of course, you can go overboard making some really elaborate designs that only four color process printing can faithfully reproduce. Naturally, these will be pretty; but with beauty comes expense. Four color plates require four color separation by either the artist or the photoengraver that must register perfectly with each other to accurately reproduce the design. Such care, precision and know-how is expensive in the commercial houses. Unless you have experience in commercial art, these designs are best left to the commercial artist.

Less involved processes are adequate for QSL printing and will be covered in this article. Each of the three phases to be covered is capable of very attractive designs. Following the instructions and illustrations carefully will enable you to make the illustrated designs and also to branch forth into creations of your own. The three phases of plate-making to be covered are: single color linecut, two color linecut, and combination halftone and linecut.

Part I

Designs from Single Linecut Plates

Images containing no gradation of shading are linecuts. Original artwork for linecuts contains lines with no variance in tone. They can be heavier or thinner, but still remain black or white. Areas in the image may be left open (white) or filled in solid. When printed, lines and filled areas have the same tone density in the color selected.

To give emphasis or cause separation in design, an illusion of shading is obtained in linecut work by applying zip-a-tone to those areas. Zip-a-tone is a trade name and consists

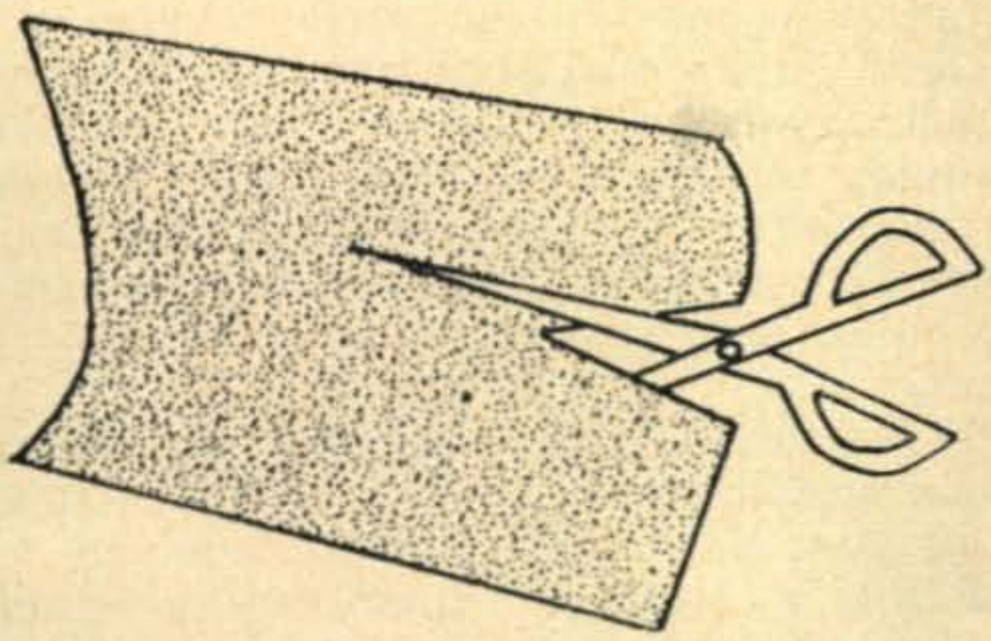


Fig 2. Cutting zip-a-tone for shading purposes in the design. Zip-a-tone pressed into place.

of line or dot patterns on transparent paper with an adherent on one side. Only one pattern is on a sheet. Numerous variations in patterns can be obtained. Sheets are available containing fine dots close spaced or medium spaced, and with either fine or medium lines of various spacing. Also available are patterns of broken lines resembling long series of dashes. See *fig 1*.

Pieces are cut from these patterns to fit areas needing shading and pressed into place. See *fig 2*. Patterns with close spaced dots or lines produce dark tones when printed; smaller dots and thinner lines or wider spaced dots and lines create light effects. Solid areas in the design are painted in with India ink.

Designs requiring only one engraved plate for printing reduce the amount of work nec-

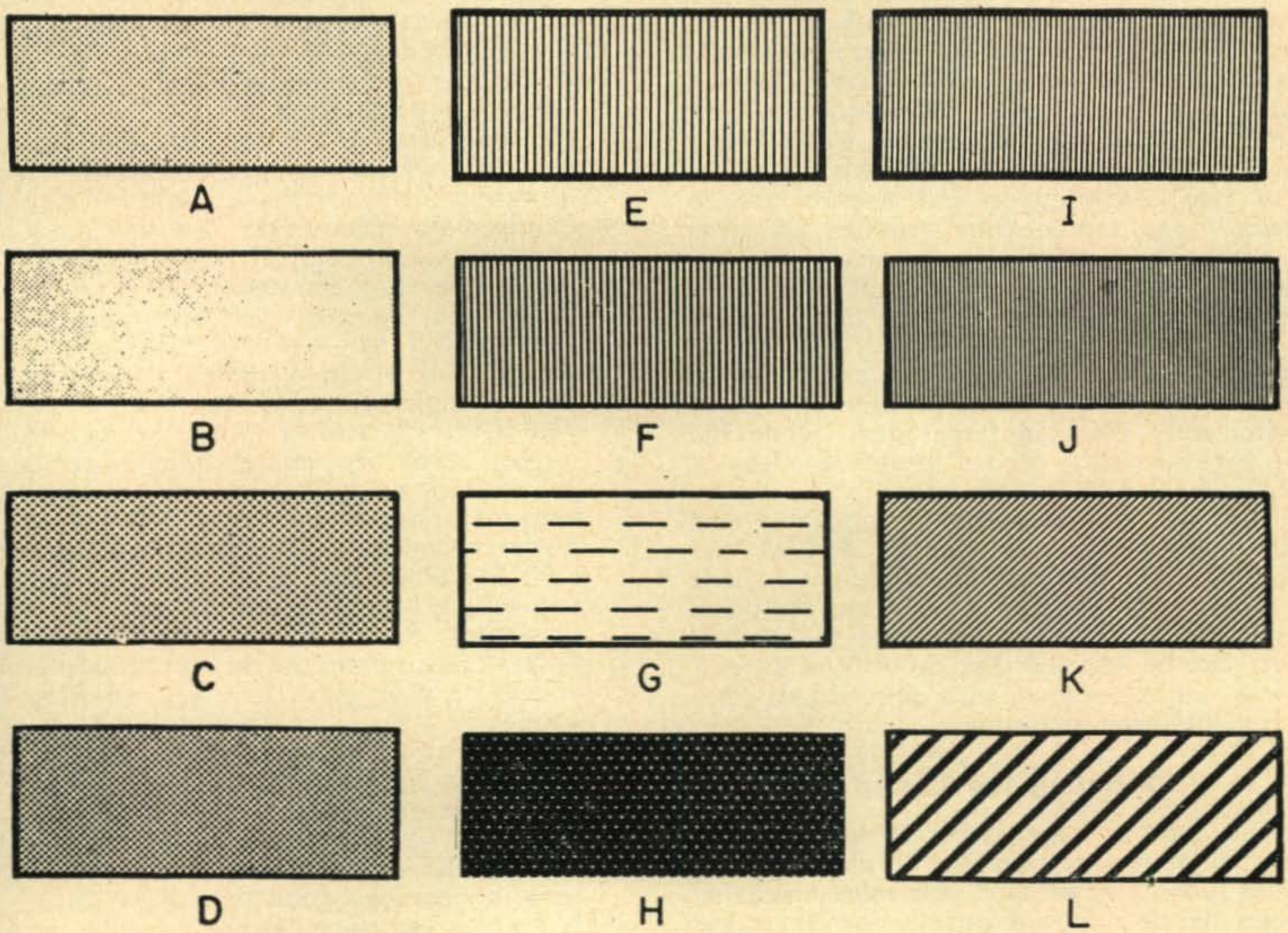


Fig 1. Samples of zip-a-tone patterns. A—Fine dot wide space, B—Fine dot close spaced, C—Large dot wide spaced, D—Large dot close spaced, E—Heavy line wide spaced, F—Heavy line close spaced, G—Broken lines, H—Medium dot in reverse, I—Fine line wide spaced, J—Fine line close spaced, K—Fine slant line, L—Heavy slant line.

essary by you or your printer. Single linecut plates eliminate color separation work by either the designer or the printer and the exacting requirement for close register.

Printing cost too will be minimum for single color designs because only one makeready and printing run is needed. (Multicolor work requires a makeready for each color plate and a separate press run for each color.) Printing costs are cheaper too if the design is an outline instead of large solidly filled areas. More ink is required for the latter and greater care must be taken that dust and dirt don't collect and cause breaks in the solid printed areas.

Tools Required

Tools required for this do-it-yourself project are inexpensive and uncomplicated. Starting with the correct tools and materials, however, is important. Basically, a few sheets of Strathmore drawing board No. 74, two small artist brushes, carbon paper, pencil, ruler, straight pen, compass, some blocked paper and a bottle of India ink will suffice. See *fig 3*.

Strathmore bristol board is indicated because the smooth white surface is very acceptable to ink. If no art-supply house exists at your location, look about for a substitute. Locate a piece of carboard with a smooth white finish such as is used for large gift boxes. Another possible source for suitable drawing board is a printing house. They probably have something left over from poster work. Prime consideration is a surface that holds ink rather than one absorbing it and causing ragged edges. Good reproduction requires all areas of the finished art piece to be sharp. This includes both the start and stop of solid areas and the outlining lines.

Two artist water color brushes are recommended. One should be a No. 4 and the other a No. 1. The No. 4 brush is large enough to conveniently paint in large areas, while the fine No. 1 brush is needed to outline edges of the design and fill in fine areas.

After the design outline is completed and solid areas filled in, it may be decided that certain remaining areas should be emphasized or separated by shading. At this time the proper pattern of zip-a-tone to obtain the desired effect can be selected. See *fig 1*. You can, of course, fill these areas with close drawn lines instead of using zip-a-tone.

Selecting the Design

What shall the design be? Removal of design limitations by switching to plate printing means nothing if we can't determine a suitable design. While only our imagination limits the design scope, how do we get our imagination working in the right direction?

While it is true the design can be anything that "pops" into mind, it should, of course, have purpose and be appropriate to your station, location, or some prevalent general theme. Individuality is accomplished if one of these conditions is met; while effectiveness of the QSL depends upon originality within these scopes. Let's toss the design problem around a little bit to find reasons for developing some designs.

FIRST—Determine if a particular subject has especial application to your station, your location or yourself. Maybe you are remotely located from civilization in lumbering or mining activities. Perhaps your profession or livelihood would capture interest if used for the theme on a card. Should neither of these seem appealing, probably a subject based on national or international interest would be best. In this category would be the forthcoming satellite launching.

SECOND—Whatever theme is selected, make sure it tells a story. There must be a reason for using it. Be careful not to end up with unassociated objects or meaningless patterns. Try to create a card design that conveys a message.

Design Suggestions

Bearing these things in mind, some design suggestions, together with reasons for selecting them, will be explored and later carried through the art steps to development.

1. Suppose specialization in relay work is the main activity of your station. Can you think of something appropriately illustrating this specialty. It could indicate that you do relay work, that you do it quickly, or that relaying is the dominating feature of your station. If all three things can be portrayed, your design message will tell the strongest story. If they can be featured while keeping the design simple for single color plate work, your QSL will achieve attractiveness and impact. Probably several designs could be worked up containing all of these features. One choice for exploration, however, could evolve around the Roman God Mercury—that swift carrier of tidings whose winged feet made him a fleet messenger. See *fig 4a*.
2. Several illustrations might be suitable if you are a river pilot. A design, showing enough of a vessel to identify your trade, with the whistle blowing should be very interesting. In the trail of escaping steam the station call letters might fit. See *fig 4b*.
3. One of the more difficult design problems is creating a good typical YL card. Numerous amusing symbols could be used such as baby carriages, lingerie, etc.; but what, aside from the comedy angle, would convey knowledge the operator is a YL? Maybe you can solve this

A B C

D E

Fig 4a. Design illustration for relay station. B—Design illustrating the work theme. C—A YL design, "going places." D—Those California kilowatts. E—Western design depicting "the new invading the old."

one which I find very hard. My best approach is a portion of an automobile driver's seat containing a smiling girl with waving arm and wind-tossed hair. The theme would be "going places." See *fig 4c*.

4. Along the comedy line, W6-land might use an atomic mushroom design representing a California kilowatt. See *fig 4d*.
5. Hams living in western states could try a design featuring a cowboy astride his horse gazing quizzically into the distance at a beam antenna. If balanced correctly, this theme of "the new invading the old" should produce a nice card. See *fig 4e*.

Creating the Design

Now that we have some design ideas, let's take the first one concerning relay stations and proceed step-by-step to create the drawing from which the linecut plate will be made.

SIZE OF DRAWING. Call cards vary slightly in dimensions but in general are approximately 3½" x 5½". Final sizes become important only when laying out design dimensions for the artwork. Instead of drawing on stock the same size as the finished QSL, the artist works to multiples of these dimensions. See *fig 5a*. He does this because finer parts of the design are easier to handle when expanded, and also because irregularities in the drawing tend to disappear when the original art is reduced to final size during plate making.

Remember, reducing dimensions to half reduces area to one quarter, therefore be sure any zip-a-tone used has a large enough pattern to give the effect wanted when reduced. See *fig 5b*. Select a piece of drawing board with dimensions twice the size your finished QSL will be plus a few inches of margin all around. On this board draw a rectangle lightly in pencil each dimension being twice the final QSL size (7" x 11"). Your design may extend to or stay within this boundry but it must not spread beyond it. See *fig 5a*.

Now we need a sketch of Mercury. Preferably it should be one of Mercury in action. Look in a big dictionary or an encyclopedia for illustrations suitable to your need. This particular image can also be found in florist section of classified telephone directory. Trace off the design by placing a piece of blocked paper and carbon paper beneath. See *fig 6*. Use a ball stylus if possible so original image

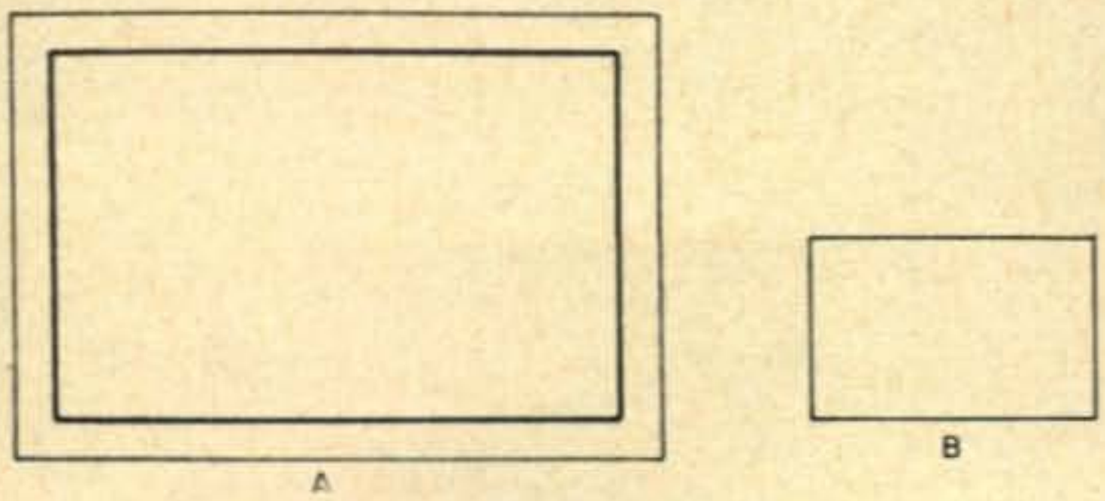


Fig 5. (a) Draw design on stock twice the dimensions of final QSL card size. (b) Reducing design dimensions to half size, reduces area to one quarter.

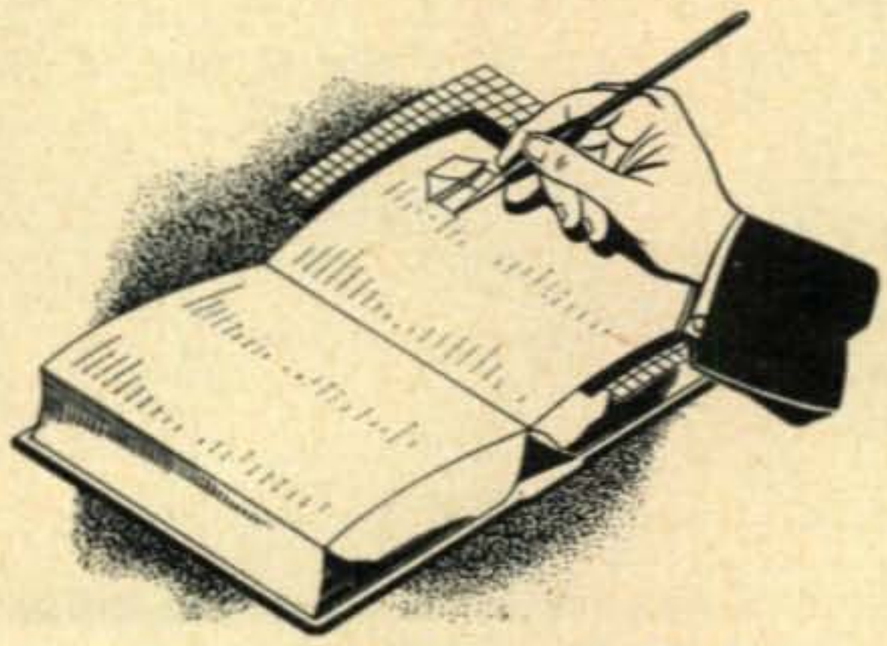


Fig 6. Tracing off objects suitable for your designs.

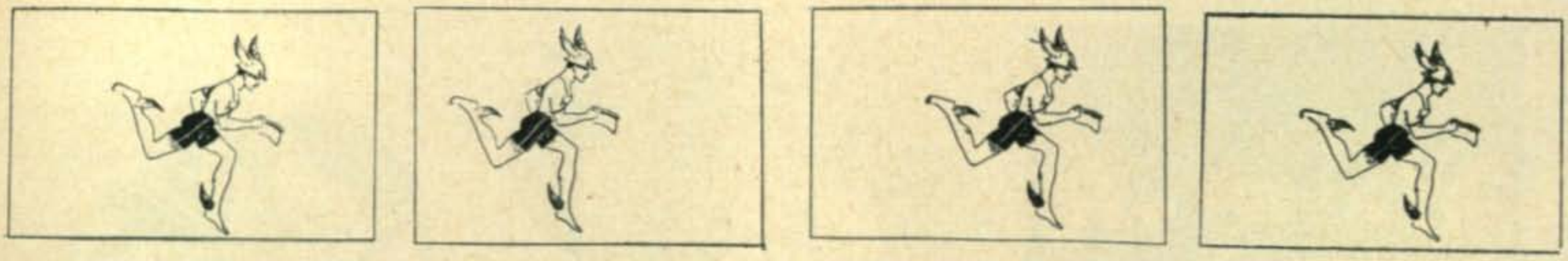


Fig 7. Balancing the design. (a) Too much forward pitch, Mercury is off balance, (b) Placing Mercury at left expresses "coming" instead of "going," (c) Object too near right side upsets layout balance, (d) Best placement for speed and balance.

won't be marred. Lay your tracing on the drawing board moving it about for position and balance. See *fig 7a, b, c, d*. Try to capture an effect of speed. Placing him near the left-hand edge creates the feeling he is coming to some destination rather than going to one. Extreme right-hand placement upsets balance of the layout. *Fig 7d* supplies best speed and balance.

As the design portrays delivery of a radiogram, Mercury is leaving your station for some destination. Keeping him on the right-hand side of the card captures the sensation of departure. Placing your call letters behind him indicates his point of departure. With these two points decided, determine the size this figure should be. Expand your tracing to fill this area by carefully redrawing or having a photostat made. By using block paper (paper filled with vertical and horizontal rules to form squares) it is easy to later expand it to the size needed for your drawing. See *fig 8*. I prefer spending a dollar and getting a photostat. Transfer this enlarged figure to the drawing board to meet your previous decision for position and balance via carbon paper technique.

With the figure of Mercury satisfactorily positioned, it's time to give thought to call letters. As the design theme is relaying, call letter importance can be held secondary. By keeping the letters small, emphasis is added to the theme. Another way of obtaining secondary call-letter importance—the one I prefer in this case—is to cause the letters to appear behind the image.

On a small strip of paper, print your call letters in pencil about three-quarters of an inch high. Slide this about the layout to find the place it blends best. See *fig 9a, b, and c*. Now

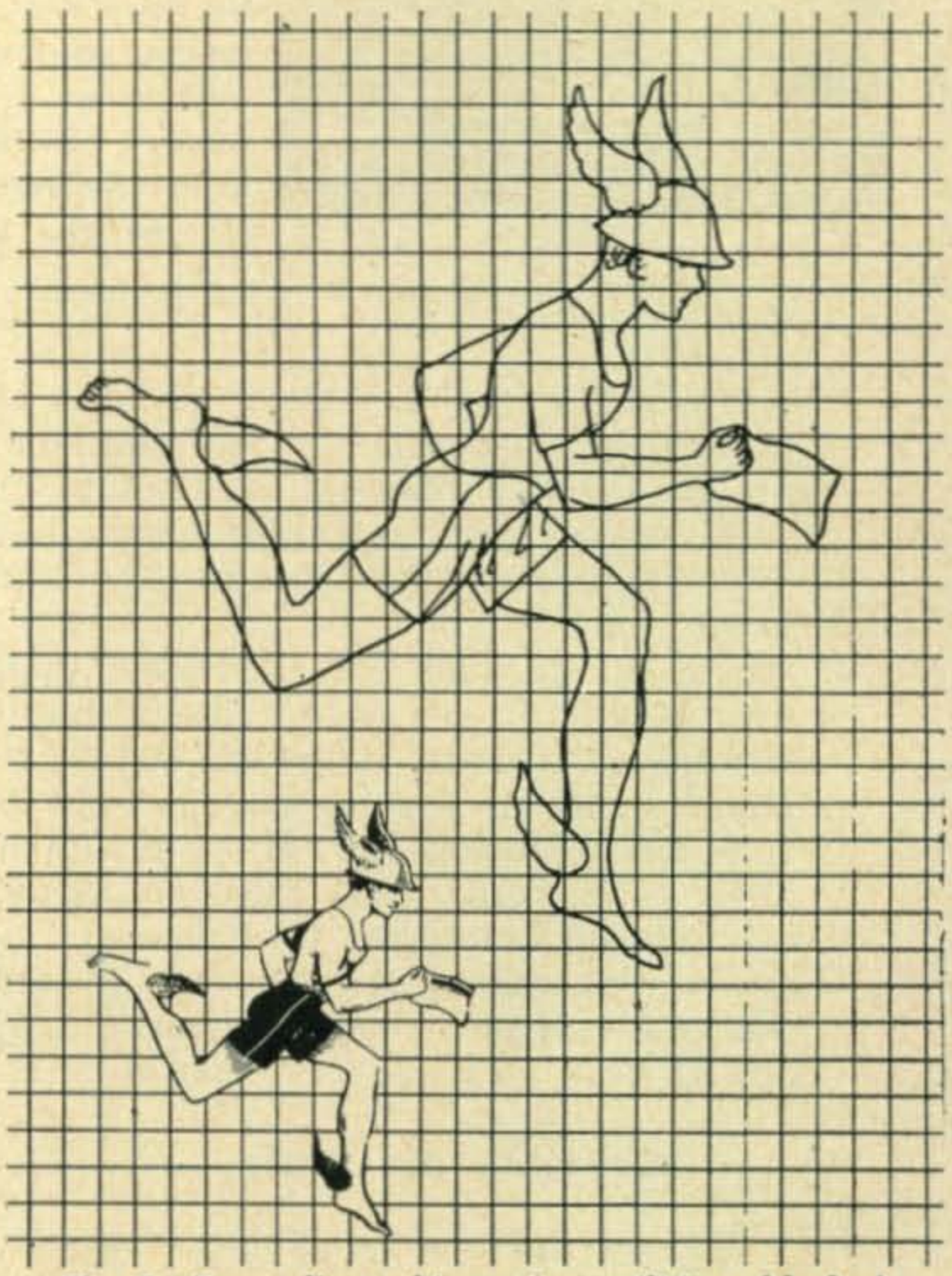


Fig 8. Expanding object size utilizing blocked paper.

check the advertising in a movie magazine for examples of lettering styles. *Fig 10* shows samples of letter variations that may satisfy your requirement; however, this scope of art is unlimited and a particular design treatment in a magazine may have just the flourish to "spark-up" your design.

Start with a serif style so the letters will have attraction of their own. Sans serif block

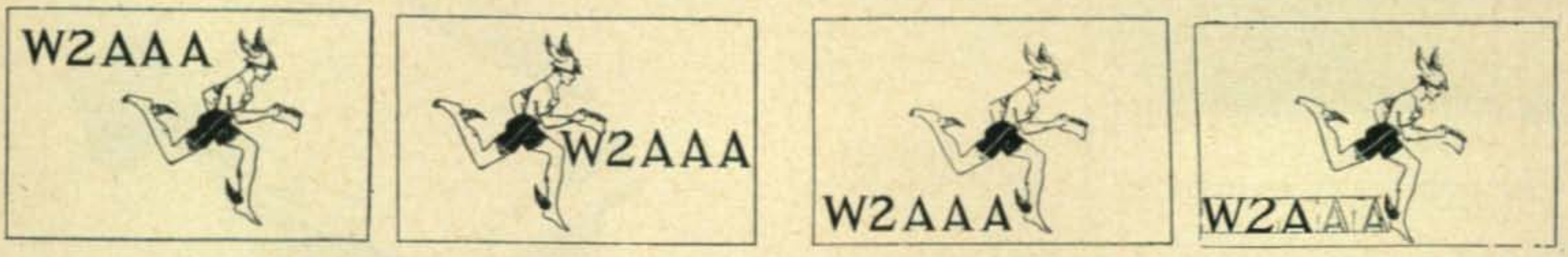


Fig 9. Sliding call letters around the design. (a) Getting feel of height, (b) Bad position; indicates Mercury is coming to station rather than going away, (c) Lower position gives less importance to call letters and strengthens design, (d) Illustrating guide lines used for layout.

Fig 11. Visualizing treatment of design. (a) Reverse treatment showing dark background with solid light image. (b) Dark background with light outlined image. (c) Background any color with image shaded in same color.

Fig 10. Samples of serif and sans serif letters.

letters have predominated on QSLs for many years so appear somewhat stale. Still, hand lettered sans serif styles are extremely popular for modern designs. Examine the lettering "Radio Amateurs' Journal" on June 1957 CQ cover. Try both styles—serif and sans serif—and select the one that fits comfortably into your design. If it tends to clash, don't use it. Serif type styles have fine lines or flares at top or bottom (or both) of the letters; sans serif means without serifs.

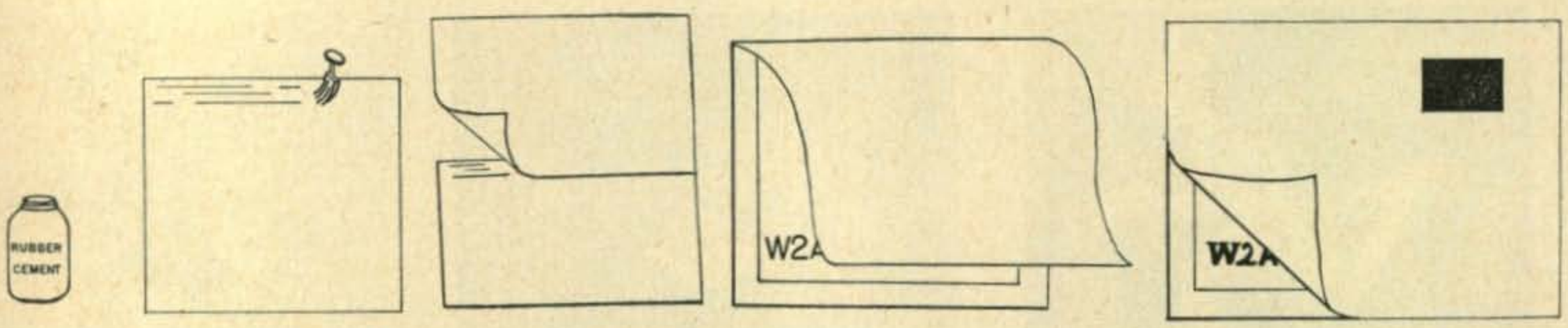
Having selected the lettering style proceed to draw the letters into your design. First, with a blue pencil, draw top and bottom guide lines and block off. See *fig 9d*. Allow full block space for all letters and figures except an "i" and a "l." Half spacing should be used for these or they will stand aloof from the others completely unbalancing your call. Blue pencil is used for all guide lines because it will not reproduce when photographed. (Blue becomes white in photography.) This eliminates the necessity for erasure with possible damage to your drawing.

Before finalizing the design, try to visualize the finished call card. Should the background appear in solid color and the image in white? Should the image be in white outline only against the solid background? Would the design be more effective if the image was zip-atoned? How should the call letters be treated? *Fig 11* shows the effect realized by each method of treatment.

Design *d* in *fig 7* seems to present the best balance and action; therefore it will be used to demonstrate finishing of artwork preparatory

Fig 12. Inking the final design. (a) Inking pencil lines with pen. (b) Inking large areas with No. 4 artist brush. (c) Inking small detail with No. 1 artist brush.

Fig 13. Protecting your artwork. (a) Applying rubber cement to top of back, (b) Laying protective cover on cemented edge, (c) Folding protection cover across face of artwork, (d) Color swatch put on cover to guide printer in matching ink.



to delivery for plate making and printing.

With the straight pen and India ink, draw over the pencil lines used for outlining, emphasis and tone separation. Using the No. 4 artist brush, fill in the solid areas with India ink. Use the No. 1 artist brush for the emphasis lines and call letters. See *fig 12*. Cut pieces of zip-a-tone to fit any areas to be shaded. Paste a piece of tissue paper along the back top edge and fold it over the front of the drawing. On this either attach a swatch or fill in the solid portions of the design with the shade of color the printer is to match. Crayon or paint can be used. See *fig 13*. Your design is now ready for the platemaker.

Take the drawing to any printer of your choice. He will have the plate made and do the printing. He can get the plate made from his regular source cheaper than you'll be able to have it done.

Choice of Color

Select a color that is pleasing to you and that will accentuate the design. If a white card stock is used, a dark color ink will give most prominence to the design. Another color scheme is available in single plate printing by using light-colored stock instead of white. Dark inks printed on these light colors produce two color designs. Numerous combinations can be used for this effect: dark blue ink on yellow or buff stock, black on yellow or orange stock. If white stock is used, I suggest the ink selected be dark regardless of color so plenty of contrast is realized. For a glossy card with plenty of color sparkle, specify that Kromekote stock be used by the printer.

In the second part of this article, techniques and instructions for creating two-color linecut designs will be covered.

(to be continued)

Killing Final Amplifier Noise

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Some grounded grid final amplifiers have been found to create noise in receivers while in standby condition. In some instances this noise condition has been accentuated by TR switches.

Marvin Campbell, W6ULB,* in Vallejo, California looked into the problem. He noticed that the audio on low level received signals was somewhat distorted, not only when a TR switch was used, but while using a separate receiving antenna as well.

Replacing the TR switch with an antenna changeover relay eliminated the noise. Likewise, with the TR switch connected, the noise disappeared when filaments of the final were turned off. The final was thus established as the culprit and the TR switch absolved.

[*continued on page 175*]

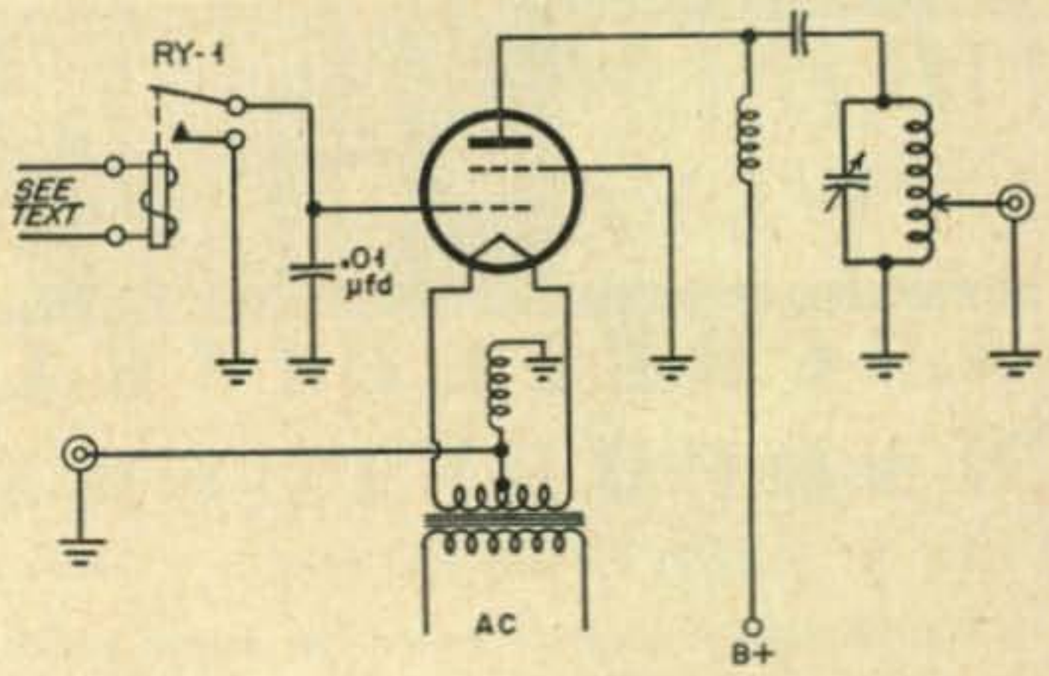

Fig. 1. A typical grounded grid amplifier with W6ULB's method of eliminating final amplifier noise added. Ky_1 can be the spare contacts on the voice control relay of some commercial exciters, or a separate relay keyed simultaneously with the voice control relay

Increasing Tube Reliability

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Conversion of AM Transmitters to DSB Operation

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Electron Tube Division,
Radio Corporation of America,
Harrison, N. J.

Are you becoming increasingly discouraged with phone operation because of crowded band conditions? Are heterodynes created by beating carriers breaking up your qso's in spite of your beam antenna and the addition to your receiver of double conversion, crystal filter, Q-multiplier, and other types of filters to sharpen your rf and if selectivity or notch your audio response? If your present final class C amplifier uses a pair of beam power, tetrode, or pentode tubes, you can easily convert your transmitter for double-sideband—suppressed-carrier operation and enjoy many of the advantages of sideband operation.

The conversion is quite simple. It consists basically of changing to a push-pull (grid-No. 1) input circuit and a parallel-plate output circuit and applying push-pull audio voltage plus some negative voltage on the screen grids (grid-No. 2). With the addition of a simple switching arrangement you can go back in seconds to your original AM and cw operation!

This article presents sufficient information of a general nature to help you convert your present transmitter or build and adjust a DSB amplifier, and describes in detail the conversion and adjustment of W2IYG's parallel 813 final operating at maximum ICAS class C telegraphy plate-voltage rating.

Circuit Conversion

The first step in the conversion of your present final amplifier is to re-wire it as shown in fig 1. The plate circuit is connected for parallel operation, and the grid-No. 1 circuit for push-pull operation. The screen grids are then connected to a step-up transformer having a center-tapped secondary. The negative screen-grid or grid-No. 2 voltage is connected at this center-tap. If a 500-ohm output winding is available from your audio amplifier, a 500-ohm line to the push-pull grid-coupling transformer should prove sufficient. Very little af power is required in the grid-No. 2 circuit because it is only necessary to supply sufficient af voltage for modulation to the proper amplifier power level. This subject is discussed further under adjustment.

When properly adjusted, this amplifier operates as follows: The grid-No. 1 input circuit operates in the normal class C fashion. When one grid is driven negative, the other is driven positive. Because the plates of the two tubes are connected in parallel through a common load, and because there is a normal 180-degree phase shift between the tubes, the instantaneous voltage at the plate of each tube is equal and opposite to that of the other tube. Under these conditions, voltages in the plate circuit cancel, and rf output is zero, causing complete carrier cancellation (at balance only). For a given dc plate voltage and rf grid-No. 1 voltage, the static or idling dc plate current therefore is influenced only by the value of negative dc grid-No. 2 voltage.

When audio voltage is applied to the screen grids in a push-pull arrangement, one screen grid is driven positive while the other is driven negative. The tube with the positive-going screen-grid voltage begins to conduct, while the tube with the negative-going screen-grid voltage remains cut off. Each tube, therefore, produces power for only one half of the audio cycle. During the next half cycle tube operation is reversed, and the tube which was previously cut off begins to deliver power. Both sidebands are produced alternately by each of the tubes. The plate current in this case is influenced by the combination of negative dc voltage and af modulating voltage on the screen grid.

Another interesting feature is that the amplifier is *self-neutralizing*. As shown in fig 1, the grid-No. 1-to-plate capacitance of one tube acts as a neutralizing capacitor for the other tube. When one tube is conducting, the other is cut off. The tube which is cut off serves as the neutralizing capacitor in a conventional capacitive-neutralizing system for the tube which is conducting.

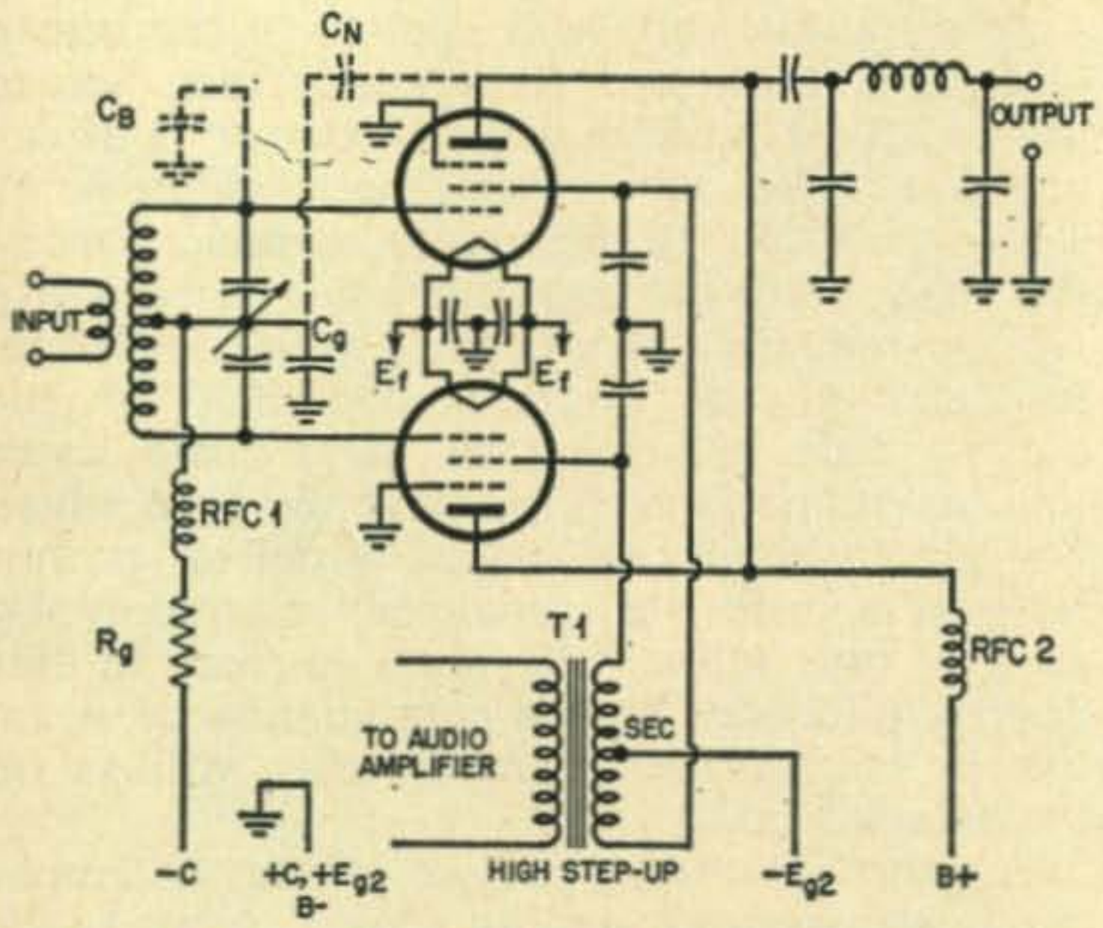
Adjustment

Adjustment of the DSB class C amplifier is straightforward. However, particular attention should be given to the following items: (1) The value of negative dc screen-grid or grid-No. 2 voltage, (2) amplifier balance, and (3) the value of af grid-No. 2 voltage.

DC Grid-No. 2 Supply Voltage

The negative dc grid-No. 2 voltage for proper operation of the DSB amplifier must be determined experimentally. A 90 volt "C" battery may be used for initial tests. It is suggested that the plate-supply voltage be controlled with a Variac or that a 5000-ohm high-wattage resistor be used in series with the

plate supply to provide tube protection during the initial adjustment of the screen-grid voltage. With full ICAS class C telegraphy, plate voltage, and normal rf drive to the input circuit, the grid-No. 2 voltage is adjusted for plate-current cutoff. The value of negative dc grid-No. 2 voltage is not critical. Numerous tests were run with negative voltages ranging from almost twice the plate-current-cutoff value to values at which static plate currents were high enough to cause almost full plate dissipation. Operation under these extreme conditions, however, is not recommended. At too high a negative screen-grid voltage, a pattern like the one shown in fig 2B is obtained. Because more af driving voltage is required for a given rf output with a high negative grid-No. 2 voltage, audio distortion is more likely to occur in the modulator as a result of operation at increased af gain. Operation at too low a negative screen-grid voltage is wasteful of dc input power.



C_N–NOT REQUIRED FOR DSB–SC AND HAS NEGLIGIBLE EFFECT WHEN LEFT IN, AS IS DESIRABLE FOR AM–CW OPERATION.
C_B–BALANCE CONTROL (SEE TEXT)

FIG. 1

After proper adjustment of dc grid-No. 2 voltage, the plate tank circuit is tuned to resonance with the aid of a sensitive rf galvanometer or field-strength meter. The circuit is tuned for a maximum reading on the rf indicator. This reading indicates the presence of carrier which may be strong enough to require suppression. A check with local sources will give this answer.

Carrier Suppression Adjustment:

After the reading on the rf indicator is noted, the ends of the grid coil should be touched one at a time. (If the wire is uninsulated, a piece of tape should be wrapped around your finger.) If there is no reduction in rf indication, the final is balanced. If there is unbalance, a small variable capacitor should be connected to the end of the grid tank which causes carrier reduction. This capacitor should be adjusted for minimum carrier. The final is now balanced. The balance must be checked, however, if you change bands. If the grid coils are symmetrical, one small variable capacitor of about 10 $\mu\mu$fd should prove suitable. If the plug-in strip is symmetrical and your coil can be plugged in either of two ways, mark the correct way for the coil to go in after it is balanced in the amplifier. For multi-band operation, a small balancing capacitor may be used in each grid coil as a padder across the tuning capacitor.

AF Grid-No. 2 Voltage:

The adjustment of af grid-No. 2 voltage must be made properly if serious distortion and excessive bandwidth are to be avoided. It is advisable to use an oscilloscope for this adjustment. The test setup is shown in fig 3. This test should be made before the transmitter is put on the air because it provides direct indication of transmitter performance. This test will be discussed in detail later. At this point it might be well to consider the development of the necessary af modulating voltage.

Because the screen grids represent a relatively high impedance load, very little audio power is required for modulation. The main requirement is that sufficient af voltage be available for modulation of the rf amplifier up to the point at which distortion and nonlinearity occur. At W2IYG an rms voltage of about 180 volts (per tube) was required for the 813's. Although no information is available regarding the exact af modulating voltage required for other tube types, an rms voltage (per tube) of about *twice* the value of the negative screen-grid voltage required for cutoff should be sufficient. Any 5- or 10-watt audio amplifier should be adequate provided it has a high transformer step-up ratio. Some experimentation may be required. (See the DSB article in last month's CQ.)

the Exciter:

It is *essential* that the VFO of your exciter be very stable! Otherwise, it becomes very difficult for your signal to be copied. Your "on the air" checks will show up instability immediately, so keep your VFO on zero beat.

Tune-Up:

Although output-circuit tune-up might appear to be a problem with this type of amplifier because of the suppressed-carrier feature, it is in fact very simple. With the input circuit tuned to resonance and normal flow of grid-No. 1 current, it is necessary only for you to whistle into the mike while resonating and loading the output circuit. Depending on your particular arrangement, the input circuit can easily be returned to parallel operation and B+ applied to the screen grids. At W2IYG this connection is made in seconds by a plug-in

coil arrangement (fig 4A) and switch (fig 4B) which returns the amplifier to cw or AM service.

The very nature of this circuit provides excellent tube protection because, even with full plate voltage and no grid-No. 1 excitation, no plate current flows because of the negative grid-No. 2 voltage. Here is real foolproof operation!

Final Testing:

After the circuit and tube operating conditions have been established, one final test should be made with the aid of an oscilloscope to check the sidebands for distortion and nonlinearity.

With the transmitter under dummy load and a test setup similar to that shown in fig 3, tone modulation is applied and the rf pick-up link for the scope is adjusted until complete waveforms appear. If grid-No. 2 negative voltage is correct, af voltage is not excessive, and the amplifier is properly balanced, symmetrical waveforms such as those shown in fig 2A should appear. With excessive modulation, waveforms such as those shown in fig 2C and 2D will appear. Fig 2C shows "flat-topping" of an otherwise symmetrical waveform. When "flat-topping" occurs, the signal sounds distorted and begins to spread out and take up excessive frequency space. Fig 2D shows a combination of "flat-topping" and increased nonlinearity which creates serious interference. Fig 2E, with carrier showing, is caused by unbalance.

For those who do not own or have access to a scope, a low-range milliammeter (5 or 10 ma.) connected to read screen-grid current on one of the tubes will aid in the modulation adjustment. The screen grids should not draw current or distortion may occur. If there is doubt about the adjustment, the gain control should be kept low and some "on the air" tests made to determine the best setting of this control.

Typical Conversion

The test conversion made in one evening of the 813 transmitter at W2IYG was accomplished as follows:

The grid-No. 1 input circuit was converted for push-pull arrangement. This conversion was quite simple because plug-in coils were used in both the input and output circuits and a split-stator capacitor was being used. A push-pull input coil having a center link was constructed and the plug-in coil strip was rewired, as shown in fig 4. Conversion of the plate circuit was not necessary because of the original parallel arrangement.

Next, the grid-No. 2 (screen-grid) circuit was rewired as shown in fig 1. This operation involved only the disconnection of the positive screen-grid supply voltage and the removal of

[*Continued on page* 182]

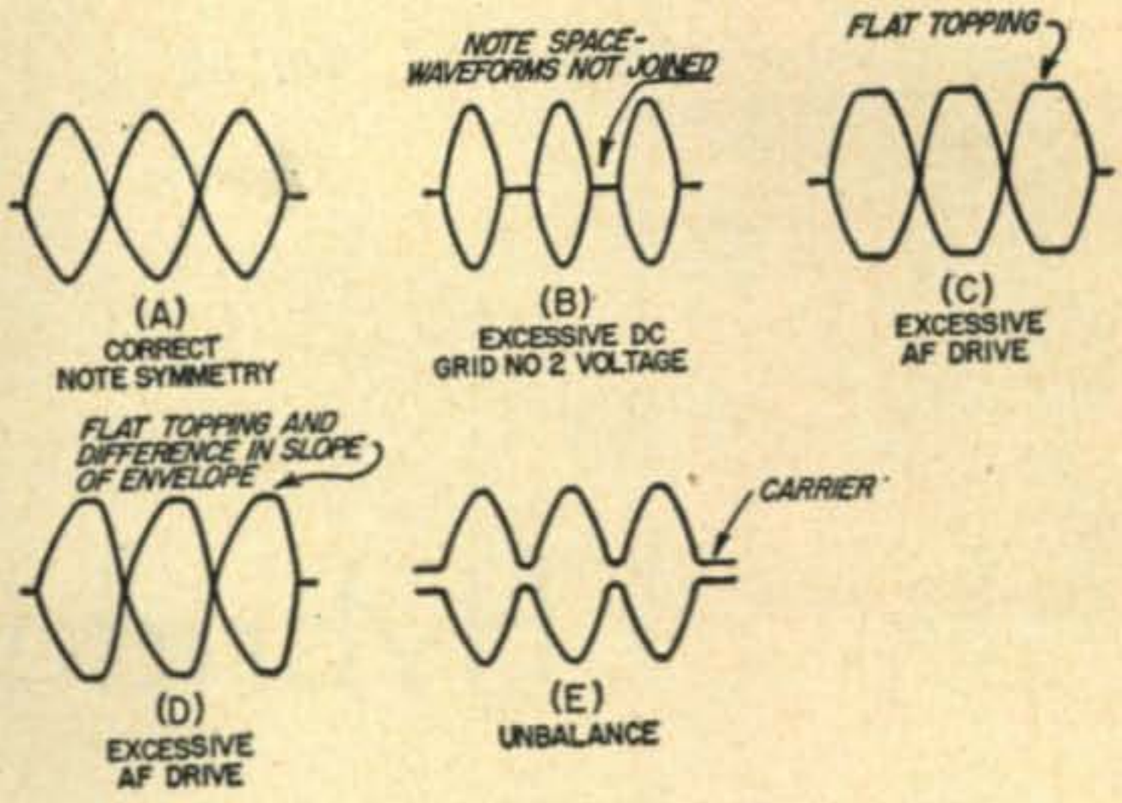


FIG. 2

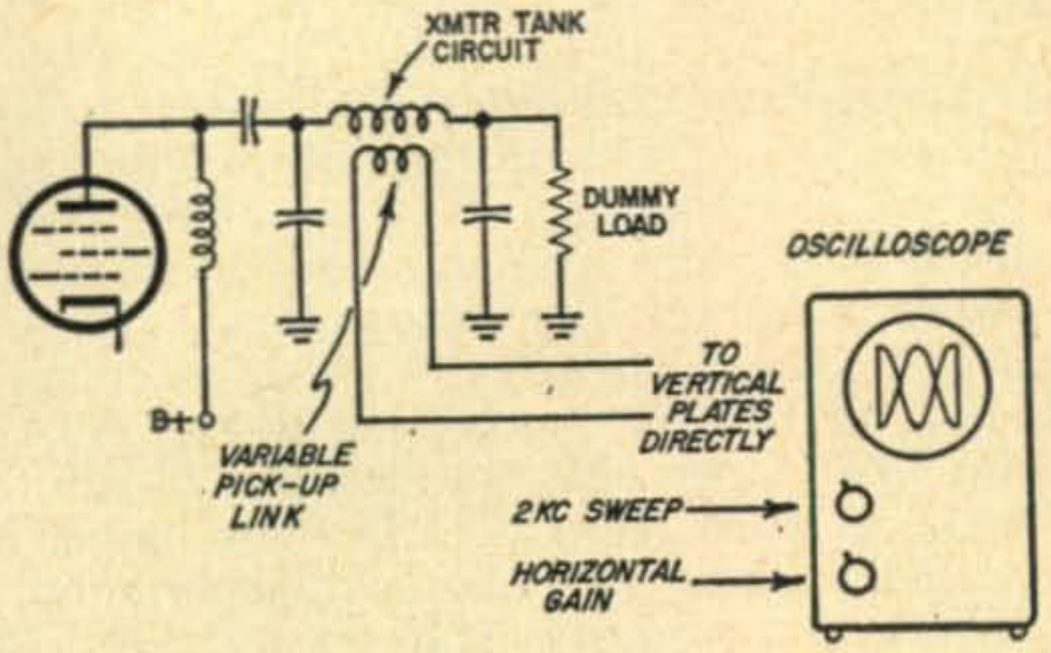


FIG. 3

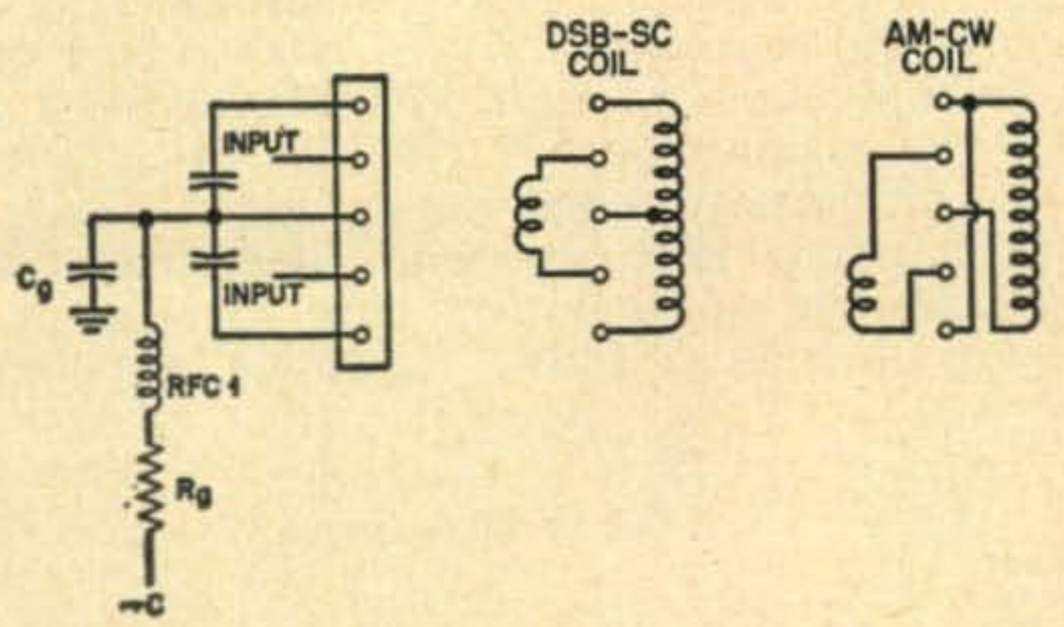


FIG. 4A

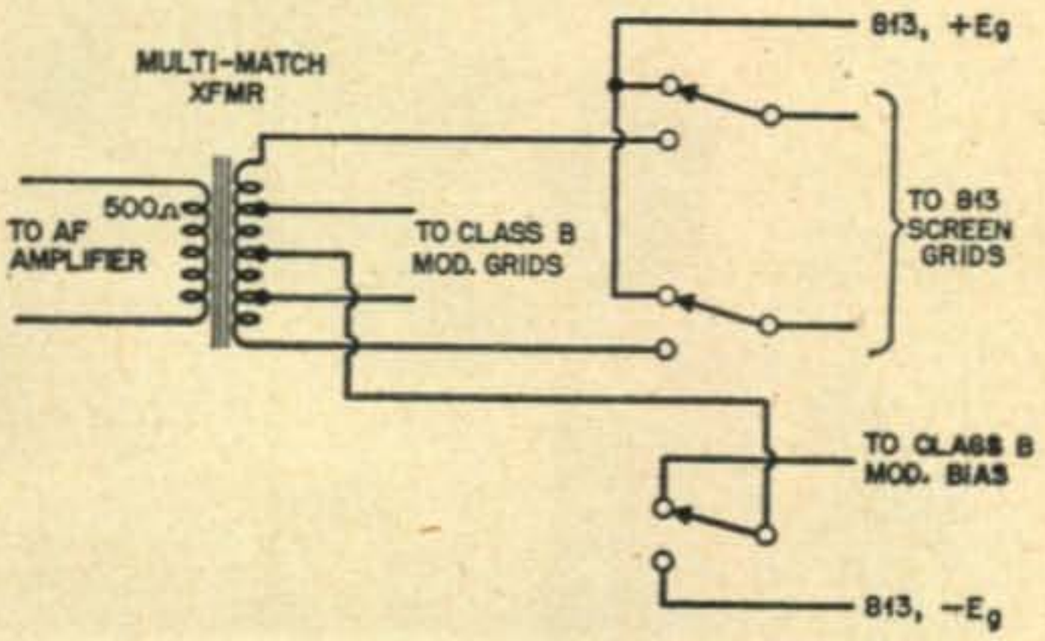


FIG. 4B

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Complete phone patch theory and practical application to switchless circuits

Hybrid Husbandry

Considerable changes have taken place in the techniques of ham radio since I first got on the air 18 years ago. To some of the real die-hards ham radio is being robbed of its romance by such unradio-like innovations as SSB and RTTY. There is room for a little nostalgia and a tear or two for the passing of the 203A and the side-swiper key, but we can ill afford to make a career of it. "Old Dobbin" might have provided some picturesque transportation, but he was slow, dusty, and on occasion somewhat smelly. Thanks fellows! but I'll still take my Oldsmobile! After all youth must be served and there is an awful lot of it. Youth, I mean!

Some wag once said "The best place to start is at the beginning." Which is all right I guess since we have to start somewhere. Let's start at the beginning.

For years now hams have been coming up with phone-patches to end all phone-patches. Regardless of what they have to offer in the way of marrying the telephone to a radio station, the ultimate is never quite achieved. The same old alternate talk and listen periods of the regular radio circuit are just transferred to the telephone line. The disadvantages are many. The telephone subscriber (a fancy name for the person paying the bill) is used to a regular telephone system where he or she holds a normal conversation. The business of "Speak-up and then Shut-up" is a little confusing. Some people, particularly women, never do get the hang of it.

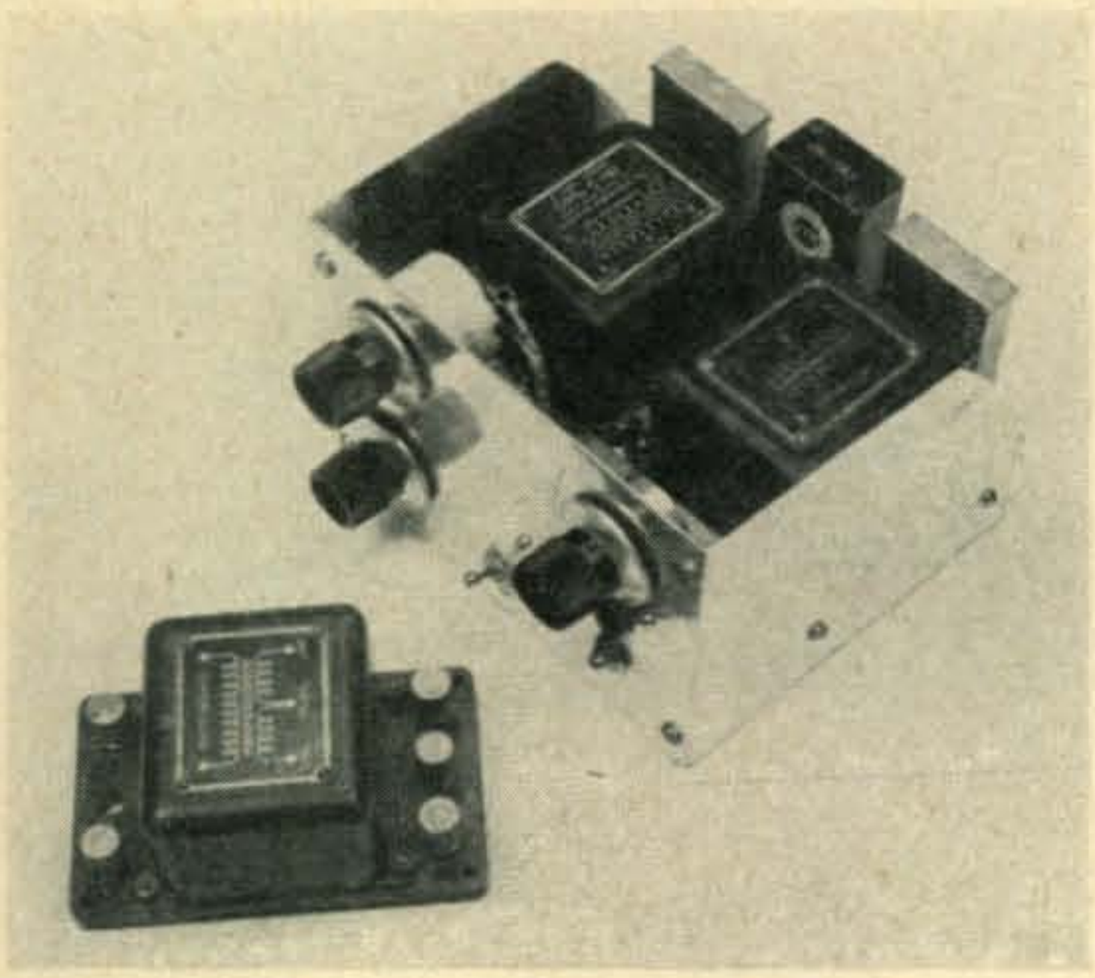
Another disadvantage is that the radio operator has to intercede and throw switches every time the conversation changes hands.

The advantages are few and not at all obvious. The chief one is that it works after a fashion.

The final solution, of course, is a lash-up that permits the telephone subscriber to operate the voice control of a SSB transmitter and receiver. This would provide a no hands system and the operator could sit back and smoke his cigar or go out for a short beer. (FCC rules and regulations permitting!) It also provides the nearest thing to true duplex operation that can be achieved in the present stage of the art.

The whole deal sounds simple at first. The logical question is "What's the big problem about that?—Just hook the telephone line to the receiver and transmitter and away we go!" Young Feller, there is a great big nasty problem. The telephone company has been very inconsiderate in the design of the telephone system. Some efficiency expert got the idea that two wires are enough to provide telephone service; just use the same wires for both transmitting and receiving. This is satisfactory for the normal levels found in telephones since the receiver on one end of the instrument and the transmitter on the other are far enough removed from one another to prevent feedback. Things aren't quite so simple when it comes to tying this telephone line into the radio system. The transmitter will be unable

The complete patch



to distinguish between the signal from the telephone line and the signal from the receiver. It will have a disconcerting habit of attempting to transmit both. The final outcome is transmission of the signal of the telephone all right but the received signal will sound like a one lung outboard motor.

Did I hear some little voice in the back of the room offer the suggestion of using the standard QT circuit to silence the transmitter when the receiver is operating? Good idea, but it won't hold water. At least not in its present form.

Let's look at the typical QT and voice circuit of the SSB transmitter and how they fit into the picture. Take a gander at *fig 1*.

Notice that the connection of the telephone line, as shown by the dotted lines, requires connection to both the receiver output and the transmitter input simultaneously. The QT circuit, not being able to differentiate between signals originating on the telephone line and signals coming from the receiver, accepts both and proceeds to paralyze the voice control circuit indiscriminately. This prevents the transmitter from coming on the air at all.

Now we have a complete reversal of our previous problem. Before, the transmitter tried to broadcast both sides of the conversation, now it is unable to broadcast either side. The receiver is working fine! Gad Zooks! Where do we go from here?

There are two possible solutions.

One involves adding an isolation amplifier after the receiver output to supply the receiver signal to the line, and at the same time keep the telephone signal from finding its way into the QT circuit. *Fig 2* shows how this added circuit would do its dirty work.

The adjustment of such a circuit could (and probably would) be a king-sized headache. Past experience with QT circuits has turned up some exasperating quirks in the little beasts. It appears that once such a circuit has been adjusted to give positive action on the receiver signal, which is several times stronger than the telephone signal, normal receiver background noises will be strong enough to prevent the weaker telephone signal from tripping the voice control. Anybody who wants to experiment with it might come up with something. The theory is good, but how it would work with practical telephone circuits is an unknown factor.

The more obvious solution therefore is to employ a hybrid circuit such as is used by the telephone engineer in designing telephone repeater equipment.

Hybrids, well known to telephone systems, are almost unheard of in amateur work, and nothing is written about them in the various "Radio Bibles" used by the average ham for references. Up to this point we have had no reason to have an interest in them. Now they suddenly appear useful.

The meager literature available here in Korea on the subject of hybrids leaves much to be desired; however, what can be found has been boiled down in some places and padded up a bit in others for presentation. It ain't much, but it's all I've got! Maybe this will prod some real expert into telling us what these hybrids are really all about.

Action of Hybrids

Hybrids fall into a single category. They are all a variation of the balanced-unbalanced a-c bridge. That is, they are balanced for a.c. injected into the circuit at one point and unbalanced when it is applied at another point. The actual circuits vary greatly between one hybrid and another, depending upon how the bridge is constructed, how the two signals are fed into the circuit, and whether the balance is obtained by direct or transformer action.

Since hybrid circuits must be balanced for one phase of their operation, there is a requirement for at least one adjustable leg of the bridge. This adjustable leg will be indicated in the following diagrams as a little black box

Fig 1.

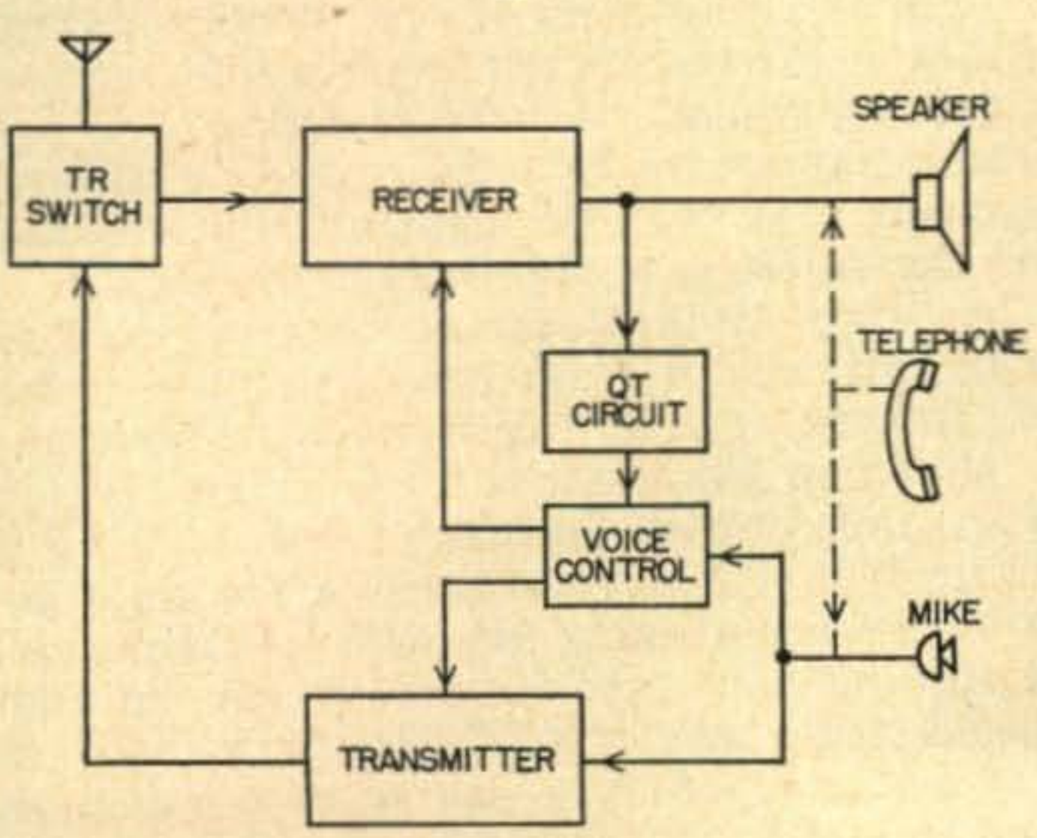
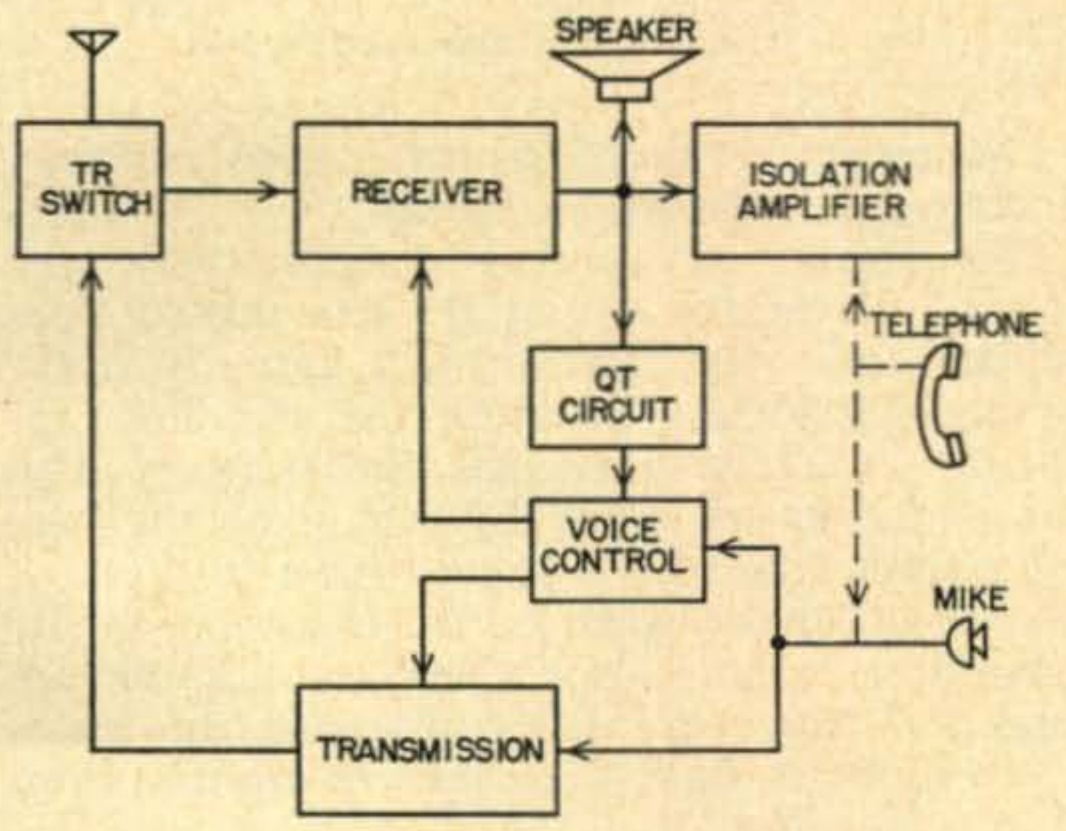


Fig 2.

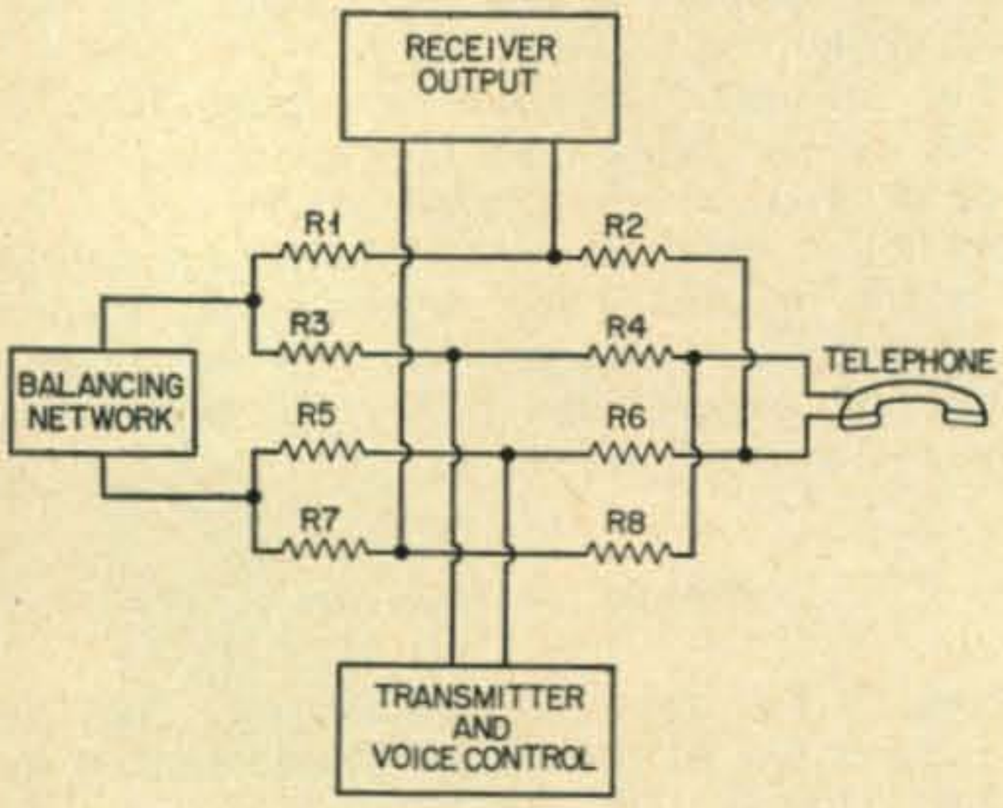


marked "Balancing Network." What is inside this mysterious little black box we'll get to later.

The simplest, or at least the cheapest, is the resistance hybrid as shown in *fig 3*.

The difficulty with this circuit is that no ground exists for the transmitter or receiver, both of which invariably require one. The use of matching transformers between the receiver, the transmitter, and the hybrid might make this circuit usable. I haven't made any experiments with it because the source of this circuit described it as a "cheap and dirty deal" and limited in its action. In other words "You don't pay much—you don't get much!"

Fig 3. Resistance Hybrid



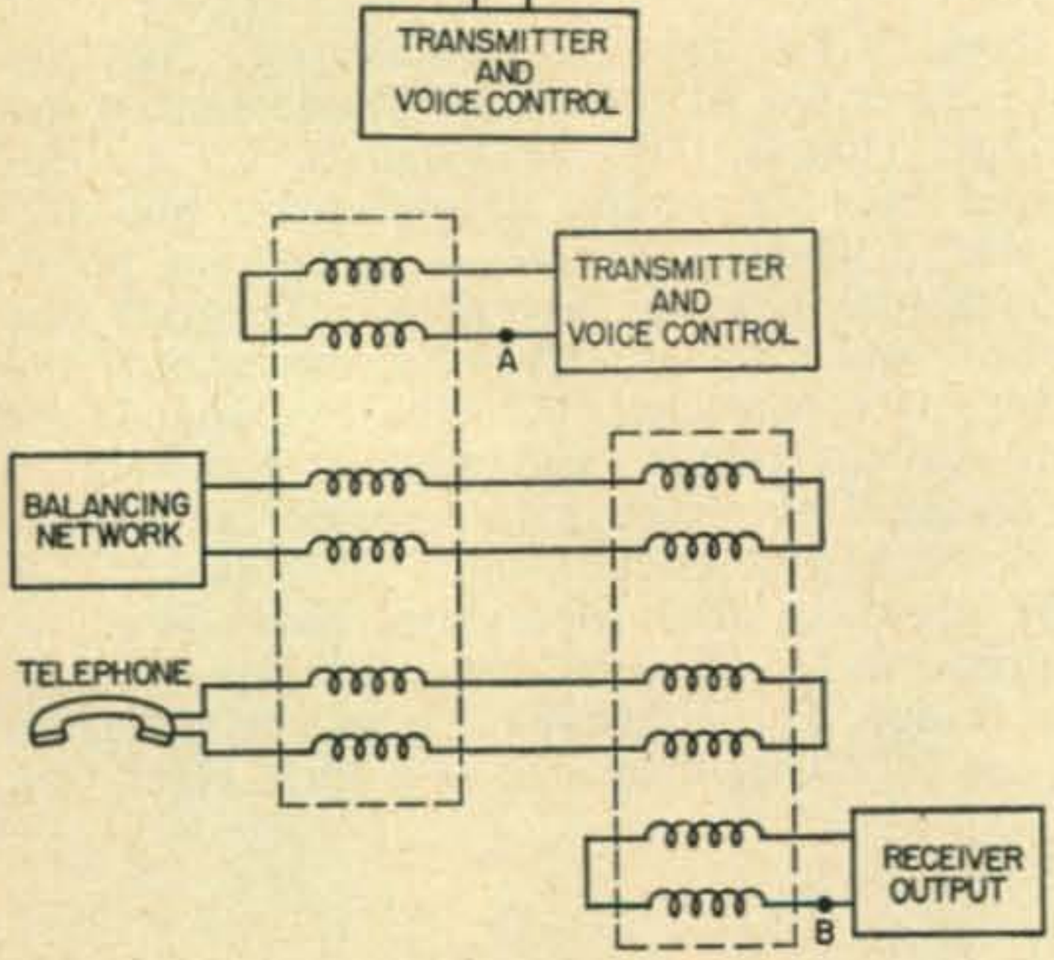


Fig 4. Common Repeater type Hybrid

The most common hybrid in use for telephone work is shown in *fig 4*.

This circuit will operate satisfactorily with grounds at points *A* and *B*. The dotted lines indicate that two transformers actually make up this hybrid and separate the windings appearing in each individual transformer. Hybrid action takes place by virtue of the fact that signals from the receiver have two equal, but out of phase, avenues of approach to the transmitter input. Since these two inputs are equal and 180 degrees out of phase, the transmitter input is unable to receive signals from the receiver output.

The telephone line on the other hand has part of its signal dissipated by the balancing network and the rest appears at the transmitter input and the receiver output equally. The signal that appears at the receiver output is lost harmlessly in the receiver output circuit components.

These transformers are strictly telephone items and are not available for amateur purchase down at the local parts store. (Try Happy Hap's Used Reseever Emporium on Sixth Avenew in Feenix!)

Anyone who has an "in" with the local telephone repeater station might be able to acquire a pair by some hook or crook. Operation would be most satisfactory. Graybar might have 'em too!

Another common hybrid arrangement is shown in *fig 5*.

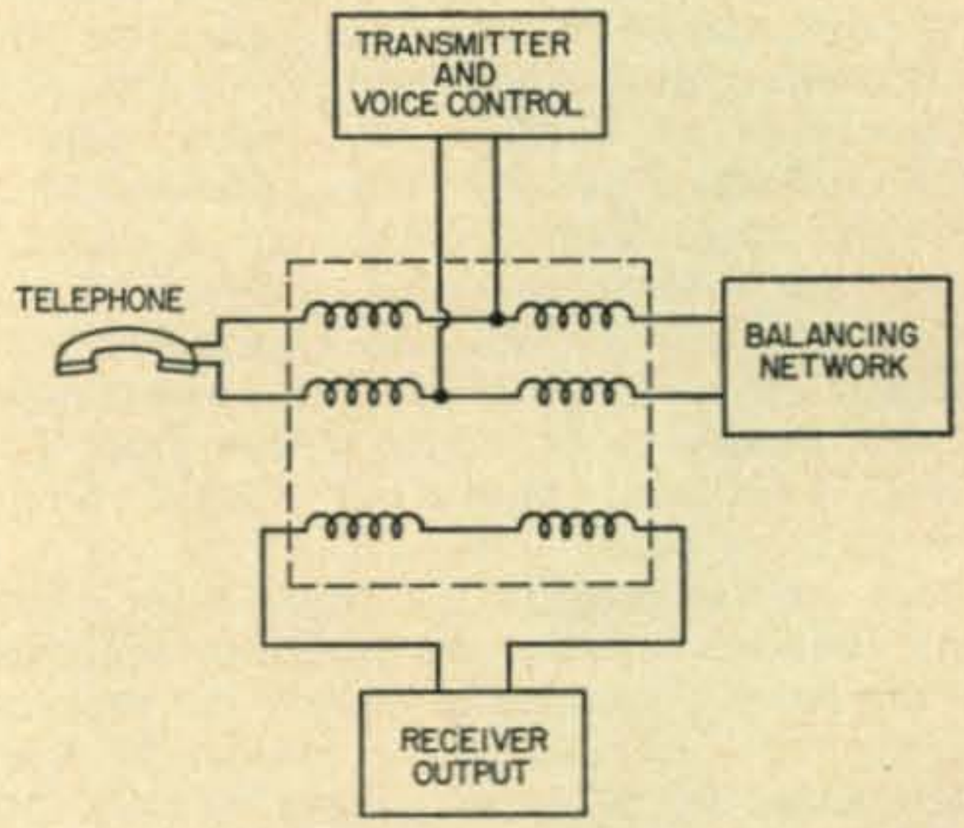


Fig 5. Balanced Hybrid

In this case all of the windings are in one transformer. Assuming that the two windings at the receiver output are considered the primary, then the other four windings are so polarized that the transmitter input is connected at a point of balance and no receiver signal reaches the transmitter. The telephone signal, however, is again split up between the balancing network, the transmitter input, and the receiver output as in *fig 4*. Grounding facilities at the transmitter input would require a matching transformer for isolation.

These commercial hybrids, regardless of how interesting they may be academically, are not quite the solution to ham requirements.

The "Ham Hybrid" should be a device that can be constructed from parts available in the junk box, or at least purchasable without undue shopping around.

Experiments with the circuit shown in *fig 6* indicate that it is a good start in the right direction toward coming up with a usable circuit for the ham type hybrid. It can be constructed from easily available parts and, at the same time, offers a degree of attenuation of the signal from the receiver into the trans-

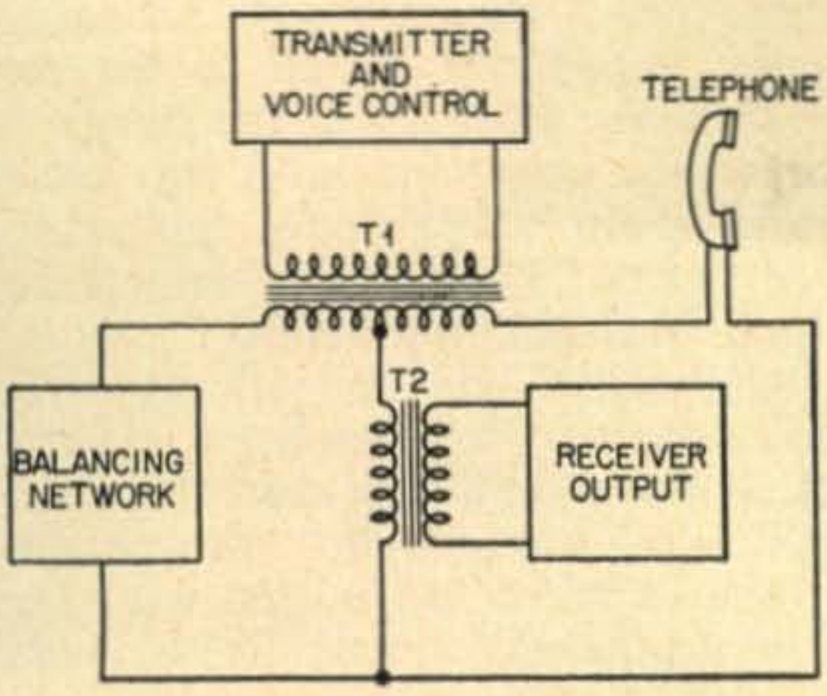


Fig 6. Basic "Ham" Hybrid circuit

mitter voice control in the neighborhood of 20 to 30 db. This is adequate for the average run of voice controls and telephone signal levels.

If it can be made to operate at all on the "Whoop and Holler" telephone systems in Korea, a stateside installation should operate "No Sweat."

Theory of operation is as follows:—Signal current originating on the telephone line flows (momentarily) as shown in *fig 7*.

Current flows through the transformer *T1* primary and induces a voltage in the secondary which is fed into the transmitter input and voice control. Current also flows through one winding of *T2* and induces a voltage into the output of the receiver. This voltage will do no harm if the usual QT circuit is not operative. *The QT circuit must be inoperative or this voltage will paralyze the voice control.*

Fig 8 shows the action of this circuit when a signal current is present from the receiver output.

The current present in the circuit caused by the receiver signal in *T2* splits, half taking a path through the telephone line by way of half of the split winding of *T1* and the other half taking a path through the balancing network by way of the other half of the split winding of *T1*. The fields set up by the currents in the two halves of the windings cancel and no voltage appears at the input to the transmitter or voice control. *This is making the assumption that these circuits are equal and of the same phase relationship!*

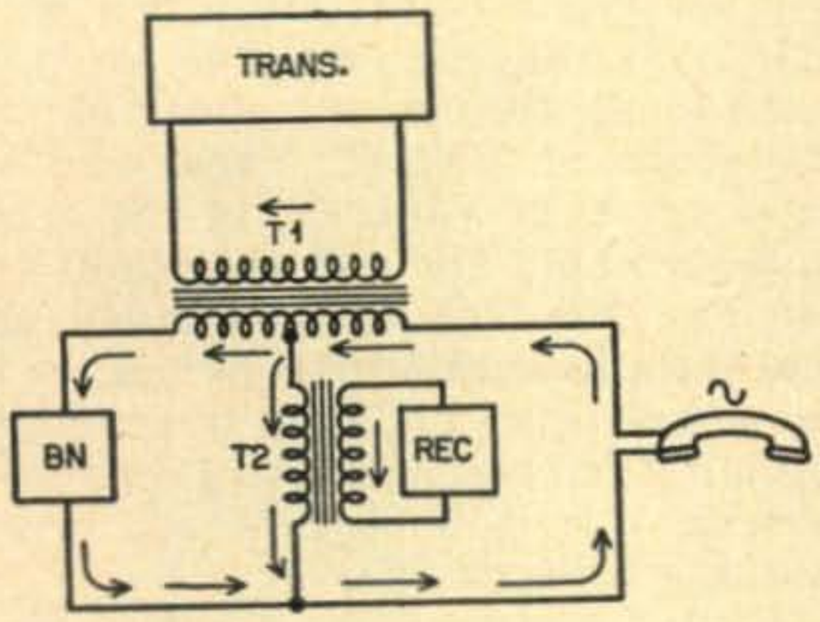


Fig 7. Momentary current flow from Telephone signal

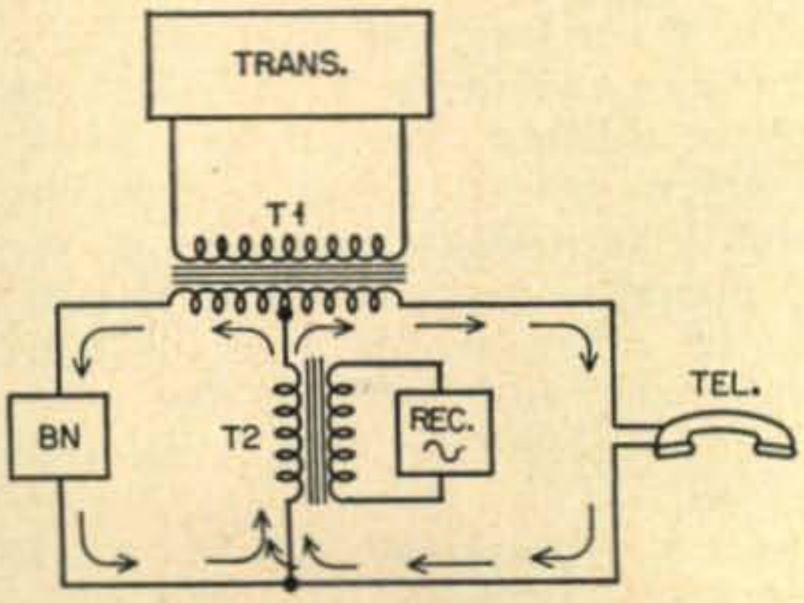


Fig 8. Momentary current flow from Receiver signal

The Balancing Network

Take heed of the Italics above. This equality of current and phase relationship are important. Without this condition, Brother, you ain't got nothin!

With a little simplification this circuit becomes a common a-c bridge. Gaze at *fig 9* and get oriented for a minute.

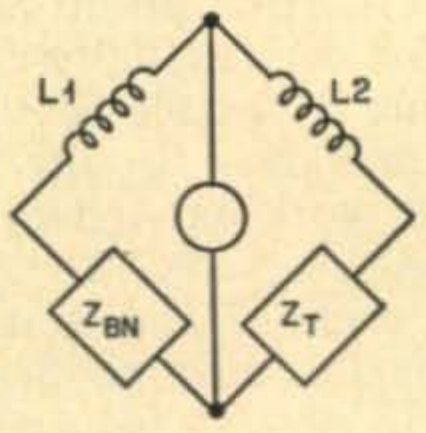


Fig 9. Bridge Equivalent

L1 and *L2* are the two halves of the split windings of *T1; Zt* is the *i*mpedance of the telephone, telephone line, and associated switchboard machinery belonging to the local telephone company; *Zbn* is the impedance of the balancing network; and the a-c generator in the middle is the receiver signal. OK hold your hats!

L1 and *L2* are fixed by construction and any alteration of their effect upon the circuit is nearly impossible. The telephone system as represented by *Zt* is a complex maze of resistance, inductance and capacitance in various quantities which will vary from one telephone to another, and will actually vary somewhat on the same telephone from call to call. Fortunately this variation is usually very small and does not seriously disrupt the overall balance of the circuit.

The telephone company takes a dim view of people who try to alter the impedance of their telephone system. It is a good idea to accept this value at whatever figure it happens to have at the moment and look elsewhere for an adjustable leg of the bridge to obtain the balance required by the assumption in italics. It shouldn't be a long search since *Zbn* is the only leg left. We have this li'l Feller right in our laps where we can adjust him all we want to and make him out of anything that happens to fit our fancy.

Before our fancy runs away with us, however, we should take stock of the situation and set some reasonable limits as to what are the

maximum and minimum values that *might* be required.

The telephone companies hire some high priced brains to assure as much efficiency out of a telephone system as possible. This is good business. It can be assumed that the impedance of the telephone system, and conse quently the impedance of *Zbn* will be predominantly resistive and in the neighborhood of 600 ohms. The average impedance of a telephone system can be approximated by 600 ohm resistor in series with a 2 mfd capacitor. These are the centers of the limits of adjustments to be expected. The maximum and minimum values will not vary more than a few hundred ohms and 1 mfd more or less.

The Experimental Model

Information on the experimental model is passed on tor those who are interested enough to want a starting point. Believe me, this is only a starting point! Some of the components used in this model may prove to be as hard to come by as the regular commercial hybrids, but, *and this is the good part*, substitutes should work as well or maybe better than the originals.

T1 and *T2* are standard *C-161* coils used universally through Signal Corps wire equipment to provide so called "Phantom" circuits. These transformers might be available through surplus channels. Literally thousands of them have been made since before WW2; some of them *must* have found their way into such outlets. They should be a drug-on-the-market. Outside of their original purpose and possibly this phone patch they are pretty useless. If they can't be found, 400 cycle power transformers (also useless) should be a logical substitute. These transformers would probably provide a better impedance match to the receiver output than the *C-161's* in the bargain. I once ran a response curve on those 400 cycle jobs and found them surprisingly flat from 150 to 20,000 cycles. There is no reason to worry about poor transmission quality!

The photo shows a *C-161* coil (in its original form) in front of the completed experimental model. If these coils are used they can be dismounted and save a lot of chassis space. The five lead wires are potted with tar into grooves in the bakelite base. These leads are made of fairly heavy wire and will withstand a brute-force removal from the grooves without preheating.

For the record I got my coils from a truckload of junk dumped on the local MARS economy.

The diagram of the experimental model is shown in *fig 10*.

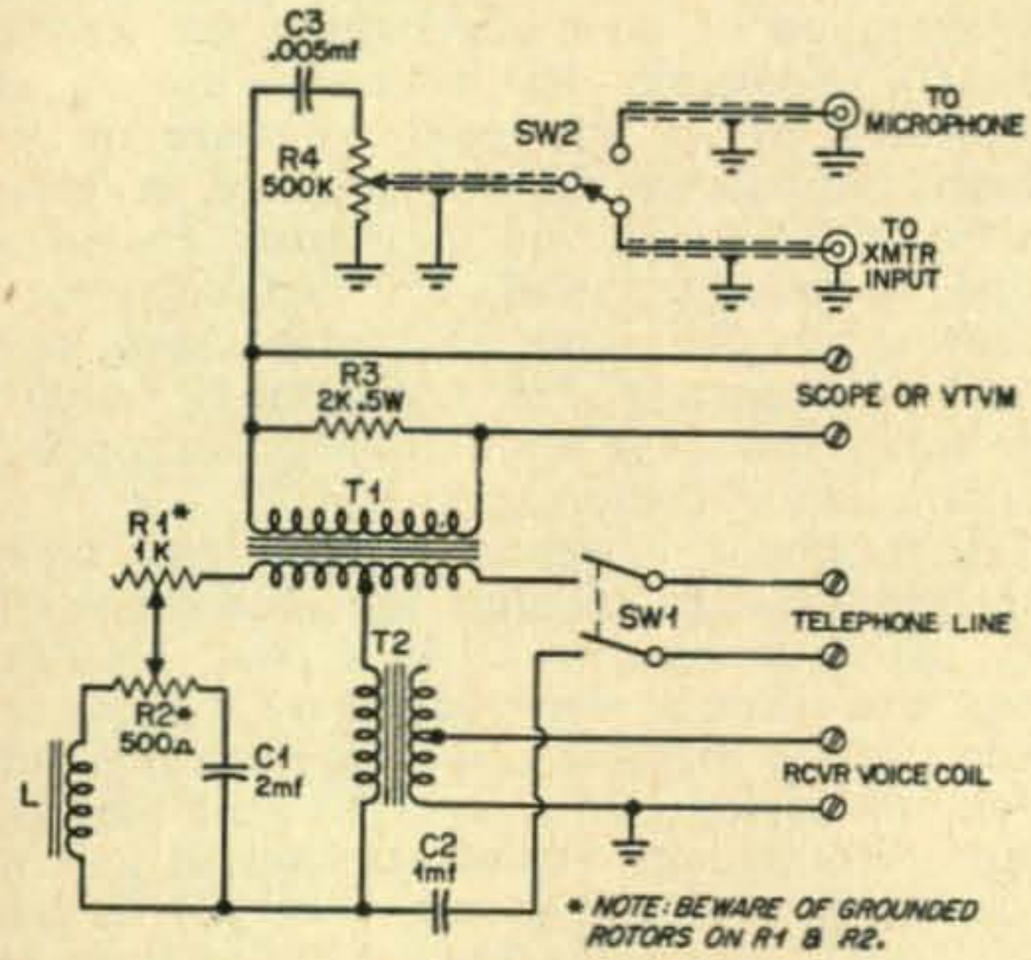


Fig 10, parts below

L—1 Hy
C1—2 mfd
C2—1 mfd
C3—.005 Button
R1—1 K Pot (wire wound)
R2—500 ohm Pot (wire wound)
R3—2 K ½ w.
R4—.5 Meg pot
SW1—DPST Switch
SW2—SPDT Switch

Adjustment

Adjustment isn't too much of a chore. Provisions have been made for a scope or VTVM across the input to the transmitter. Some such device must be used to assure as near a perfect balance as possible.

Here is the way to do it: Hook the monster across the telephone, connect the scope or VTVM, and the receiver output; then call Pete on the other side of town. (Pete has a lot of spare time!) Tune in a local broadcast station and adjust the receiver level to Pete's liking. This level will be a lot less than you previously anticipated, so start off with the receiver gain *off. The telephone company will take an unsympathetic attitude when excessive levels of signal are fed into their telephone system.* When Pete is satisfied with the level, start adjusting the two pots for minimum output of the broadcast signal as indicated by the scope or VTVM. These two controls will interact. Start with *R2* in the center position and adjust *R1* for null then hunt for the deepest possible null by alternately adjusting *R2* and *R1* a little at a time. When the deepest null is found fire up the transmitter and you should be in business. As a rule *R1* is the only control that will require adjustment for any future phone patches.

I must confess that I have never used this gadget in phone patch work. The reason is obvious once it is understood that no ham operation is authorized over here. All the preliminary tests indicate that it will work. The dummy voice control circuit kicks in nicely when ol' Pete speaks into the phone and refuses to operate on signals from the receiver output. In other words the dry-runs have been satisfactory, and until the day when W2TBZ gets back on the air that is all that can be guaranteed.

You guys take it from here! ■

Conelrad for 980 Milli-bucks

J. H. Baker, K6RKJ
Development Engineer, Autonetics
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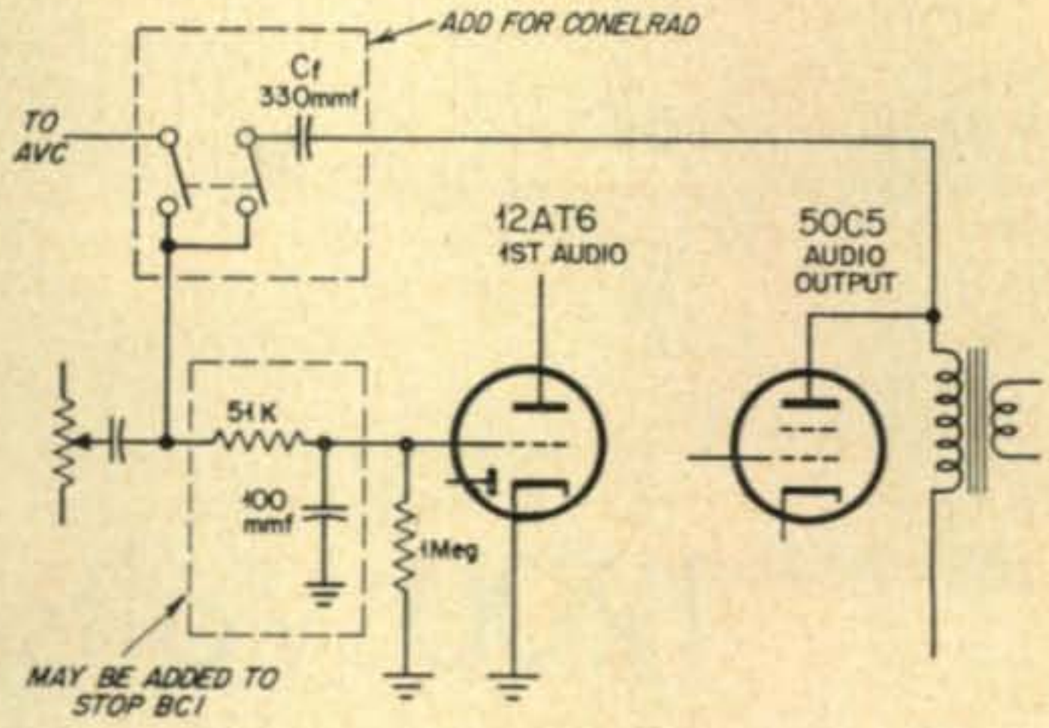

After seeing a recent article in CQ for a Conelrad circuit using three components in addition to a b.c. receiver, the writer (being of Scotch-Irish decent) could not resist devising a circuit using one less part. This part was the senstive plate relay, which is harder to come by than the remaining 330 mmfd condenser (15c) and the DPST switch (83c). This circuit uses the same basic method of alarm generation and has all the features of the earlier arrangement. Among these are:

1. Volume of alarm independent of volume control setting.
2. Silent monitoring.
3. Normal operation of the radio is returned by throwing the toggle switch.

The theory of operation is rather simple. With the switch open, normal operation occurs. Upon closing the switch while listening to a broadcast station, Conelrad monitoring is in effect. One side of the switch applies AVC voltage directly to the grid of the first audio. This cuts off the audio section of the receiver. At the same time, the other side of the switch connects the plate of the audio output (through the added 330 mmfd condenser) to the input of the first audio. This results in an audio feedback loop. It should be kept in mind that the 0.1 mfd condenser on the AVC line will shunt most of this feedback to ground. However, this is an advantage. Without this shunting action, the tone from the speaker is much louder than necessary. Condenser, C_f, may be varied to obtain a proper balance between feedback and available AVC voltage. This AVC voltage will vary with the b.c. station signal strength and the value of C_f should be chosen while tuned to the station it is planned to monitor. As long as the b.c. station carrier produces AVC voltage, the receiver is silent. When the carrier leaves the air (this can be simulated by detuning) the resulting loss of AVC allows the first audio to become active. The added condenser causes audio feedback, producing a loud tone in the speaker.

This circuit has been used on a small AC/DC set having a tube line-up consisting of 12BE6, 12BA6, 12AT6, 50C5. It is reasonable to assume that it would work equally as well on any b.c. set. If the prospective user has any doubts, a condenser and piece of hook-up wire would confirm expected results. Of course the station must be sufficiently strong to produce enough AVC voltage to cut-off the first audio. (A convenient place to pick up the AVC in this case was the "cold end" of the loop antenna which was part of the grid circuit.) The lead from the first audio grid to the switch should be kept as short as possible.

For receivers not used for Conelrad previously, it would be well to check for BCI beforehand. If required, the conventional RC network can be added at the same time.

Under monitor conditions, and with the transmitter on, the alarm should sound when the b.c. set is detuned from the broadcast station.

The writer uses a single switch to apply a.c. power to both the transmitter and the Conelrad receiver. This is necessary only for absent minded operators.

It is acknowledged that the use of audio feedback in this circuit was found in the Conelrad set-up by W4URC, published in CQ, February, 1957. The only originality claimed by the writer is the direct use of AVC to cut off the audio section. ■

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1200 Volts, Regulated

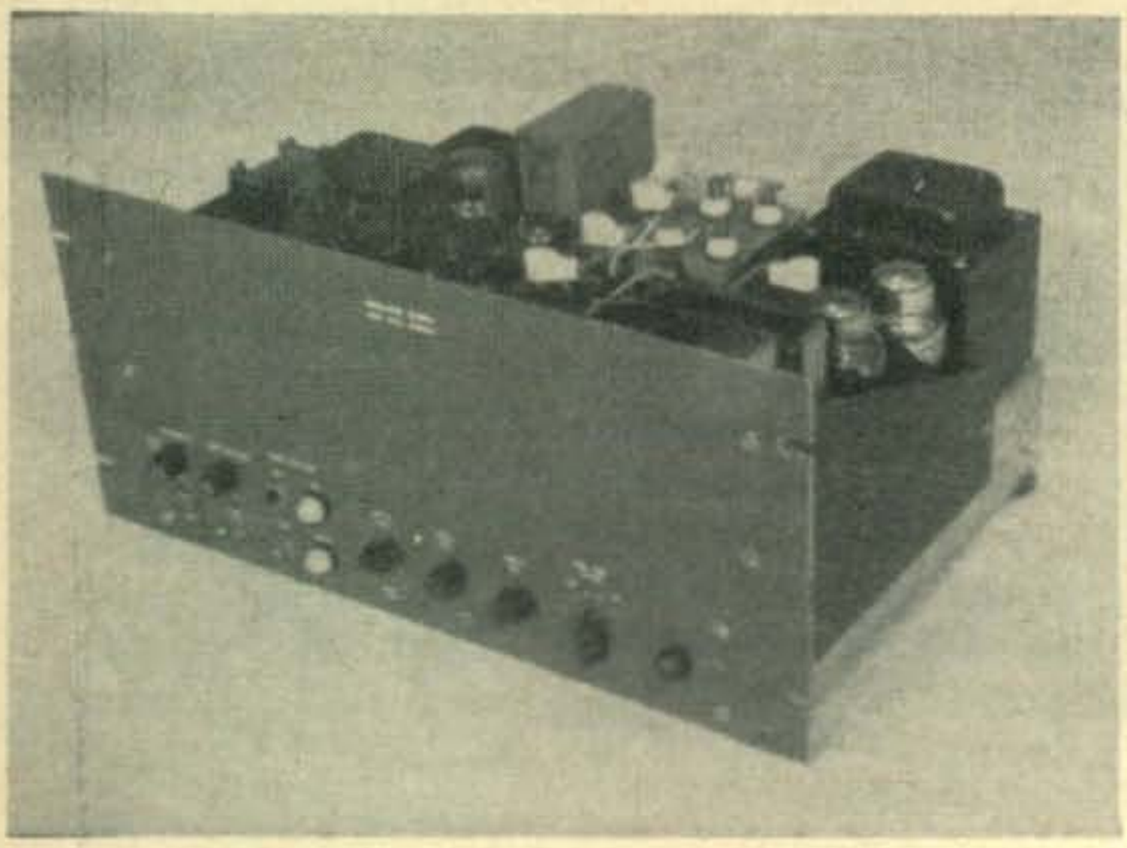
Single-sideband seems to be here to stay and the task of providing those linearly-amplified watts seems to be divided pretty well between the grounded-grid family of power amplifiers and the beam-power tetrode linear amplifier operating in class AB_1. The latter type is capable of operating with zero watts drive, but requires rather careful adjustment of operating conditions for optimum results. Plate and screen supplies must be capable of good regulation, and the grid and screen voltages should be capable of adjustment over a considerable range to achieve best operation of the amplifier.

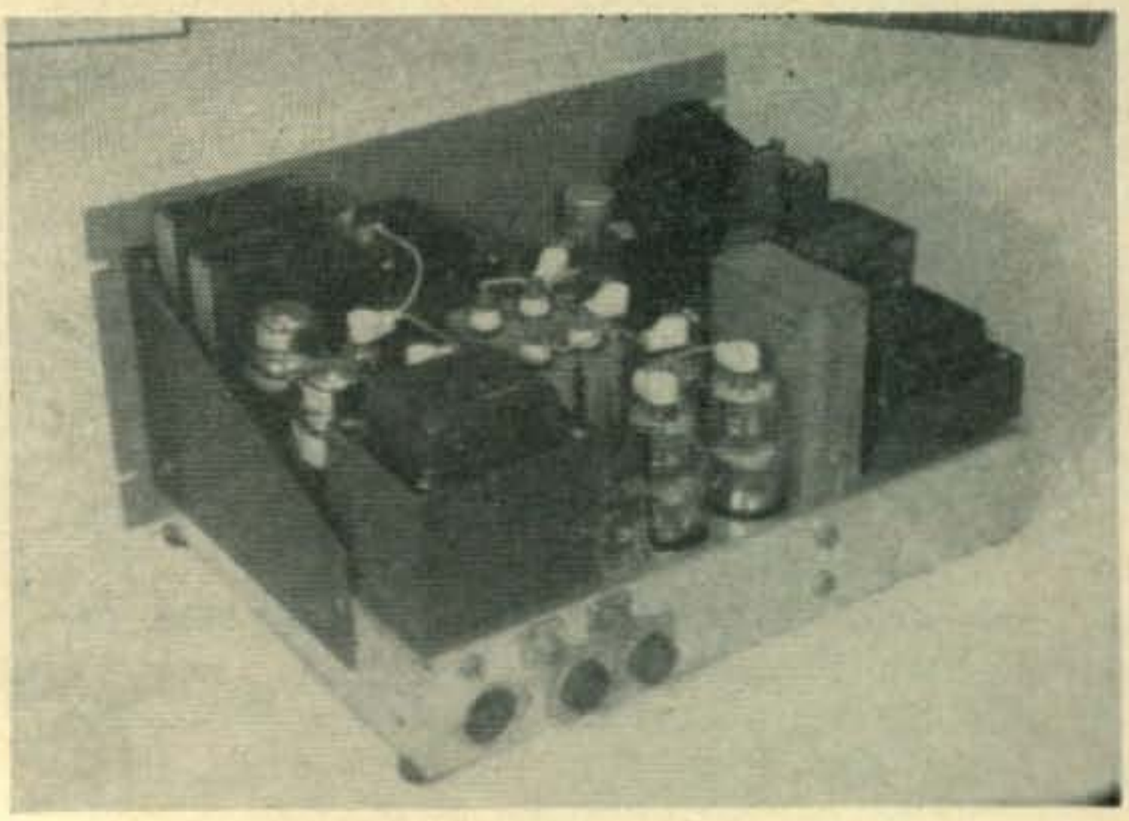
A regulated supply is advantageous for the bias too for it provides a simple method of adjusting the bias for linear operation and also provides the regulated function for c.w. operation. The article by Tooker, March 1955 CQ, page 22, describes a simple and effective lower power regulated supply.

Review of construction articles in the past few years seems to reveal a neglect of the higher power electronically-regulated power supply; such a device is worthy of attention, since it can provide both a good stiff voltage source and one with a handle on it that allows considerable adjustment. It is easy to construct a screen supply that will hold to within five volts variation at one thousand volts nominal output with a load swing of zero to 100 ma. d.c.

In the circuit of *fig 1*, two surplus 1625's are used to provide a voltage variable between 500 and 1200 volts. The continuous output is limited by the dissipation of the tubes and varies from 200 milliamperes at 1200 volts to 50 ma. at 500 volts. In typical service as a screen supply in a linear amplifier these ratings do not limit because of the transient nature of the screen current peaks.

The operation of a regulator can be best described as a servo system operating to maintain a constant output regardless of variations of load and source. In common with all servo networks this circuit compares a sample of the output with a reference voltage, any disparity is amplified as an error signal and used to cause a controller element to operate upon the output to reduce the error signal toward zero. The usual criteria of servo systems apply here, i.e., gain, frequency response and stability. The degree of regulation is determined by the gain of the error signal amplifier and the transfer characteristics of the controller element, in the case of the electronic regulator, with the tube types and operating conditions chosen, the gain varies with the magnitude of the plate





load resistor of the error signal amplifier. Speed of response suffers with larger values of the load resistor and values larger than one megohm are not usually required; the lower limit is set by the plate dissipation of the d.c. amplifier at conditions of maximum plate current. The factor of stability is taken into account by the resistors found in the grid leads of the various tubes; these suppress tendencies toward high-frequency oscillations.

In this circuit, the 6AC7, chosen because of its high gain and sharp cutoff characteristics, acts as a comparison amplifier. A source of reference potential, from a glow-discharge tube, appears at the cathode, and a sample of the output, derived from a voltage divider network, appears at the grid. Error signals, resulting from inequality of these two voltages, are amplified and used to vary the static resistance of the series controller tubes, the 1625's, to reduce the inequality toward zero.

Because of the high output voltage desired, two glow tubes were employed so that the sample of output voltage obtained from the voltage divider would not be so small compared with the output. This avoids unnecessarily reducing the gain of the amplifier loop. The 0.1 mfd capacitors across the glow tubes minimize noise pulses characteristic of such tubes, and are the largest recommended. It should be observed that this portion of the circuit is approaching that of a relaxation oscillator, such as is used with neon tubes in sweep generators, and if the glow tubes were to take off in a similar manner, regulation of the output would suffer! The 0.1 mfd capacitor between the output and the grid of the 6AC7 increases the gain of the loop to ripple frequencies and thus improves the filtering action.

In setting up the voltage divider network for specified limits of output voltage, it is necessary to decide upon a value for the potentiometer to be used, the upper and lower limits of voltage desired, and then solve two equations in two unknowns to determine the values of the fixed resistors in the voltage divider string. Because of heater-cathode potential limitations, the filaments of both the 1625's and the 6AC7 are floated above ground and require separate filament transformers. The 68K resistors across both glow tubes are not necessary for regulation action, but serve to discharge the filter capacitor in the unregulated 1500-volt supply.

It may be noted with apprehension by some that the plate voltage on that little receiving tube can rise to values somewhat higher than that recommended by the manufacturer. My experience has been that this is not harmful, because at this condition the plate current is minimum and the plate dissipation is not exceeded. Electrolysis of the glass at the base of the tube is possible, but has not caused trouble.

Triode-connected 1625's are used here in place of the low-mu triodes such as the 6AS7, because their higher mu requires a smaller voltage swing at the grid to accomplish the desired change in series resistance. Complete data may be had from the tube manuals, but some typical values for a triode connected 1625 are:

$E_g = -150$ v., $E_p = 1000$ v., $I_p = 0.005$ a.
$E_g = 0$ v., $E_p = 100$ v., $I_p = 0.050$ a.
$E_g = 0$ v., $E_p = 160$ v., $I_p = 0.100$ a.

A very good discussion of regulated power supplies may be found in the Bureau of Standards publication, *Handbook of Preferred Circuits*, prepared for the U.S. Navy. It may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. The number of the book is NAVAER 16-1-519, and it costs $1.75. Detailed design data on this and other types of regulated power supplies may be found therein, and if the one percent or so regulation provided in the circuit described above is not good enough for you, regulation of the order of 0.1% may be had if you do not mind getting a little more complicated. ■

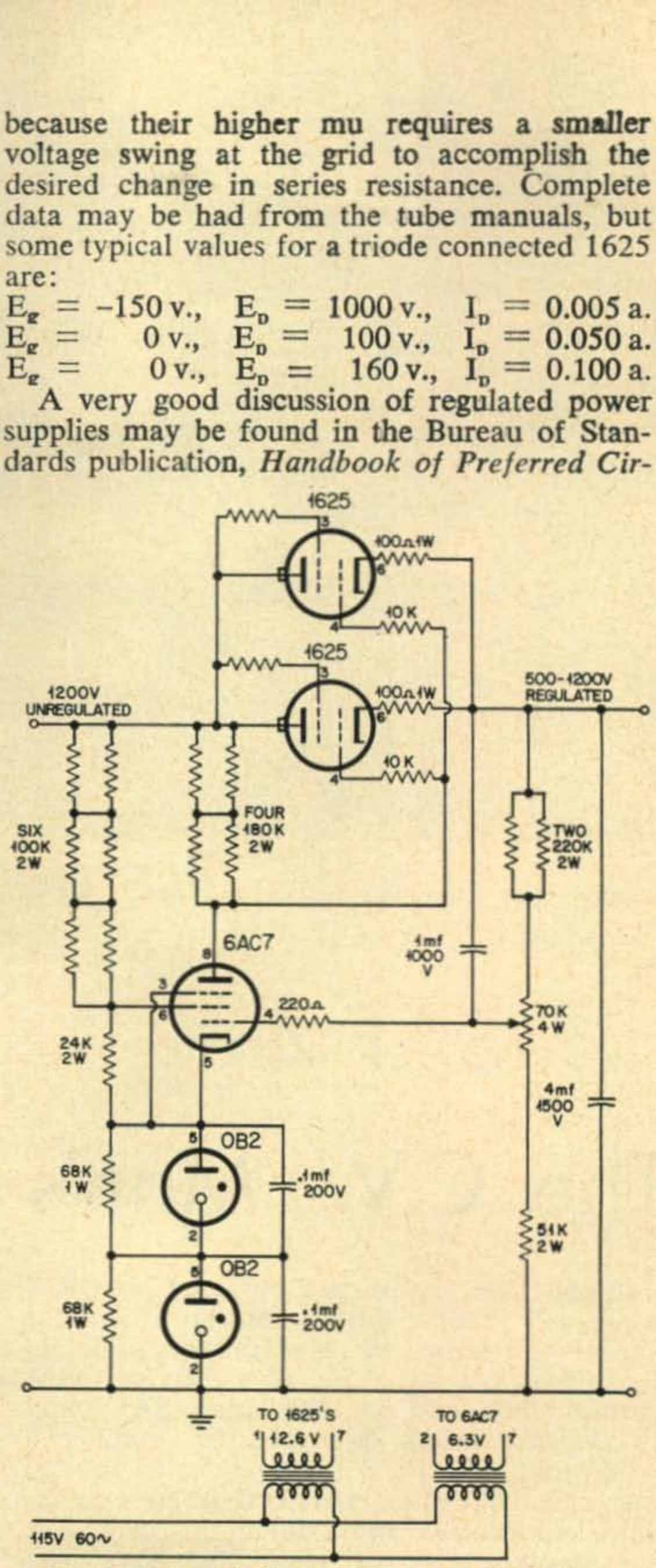
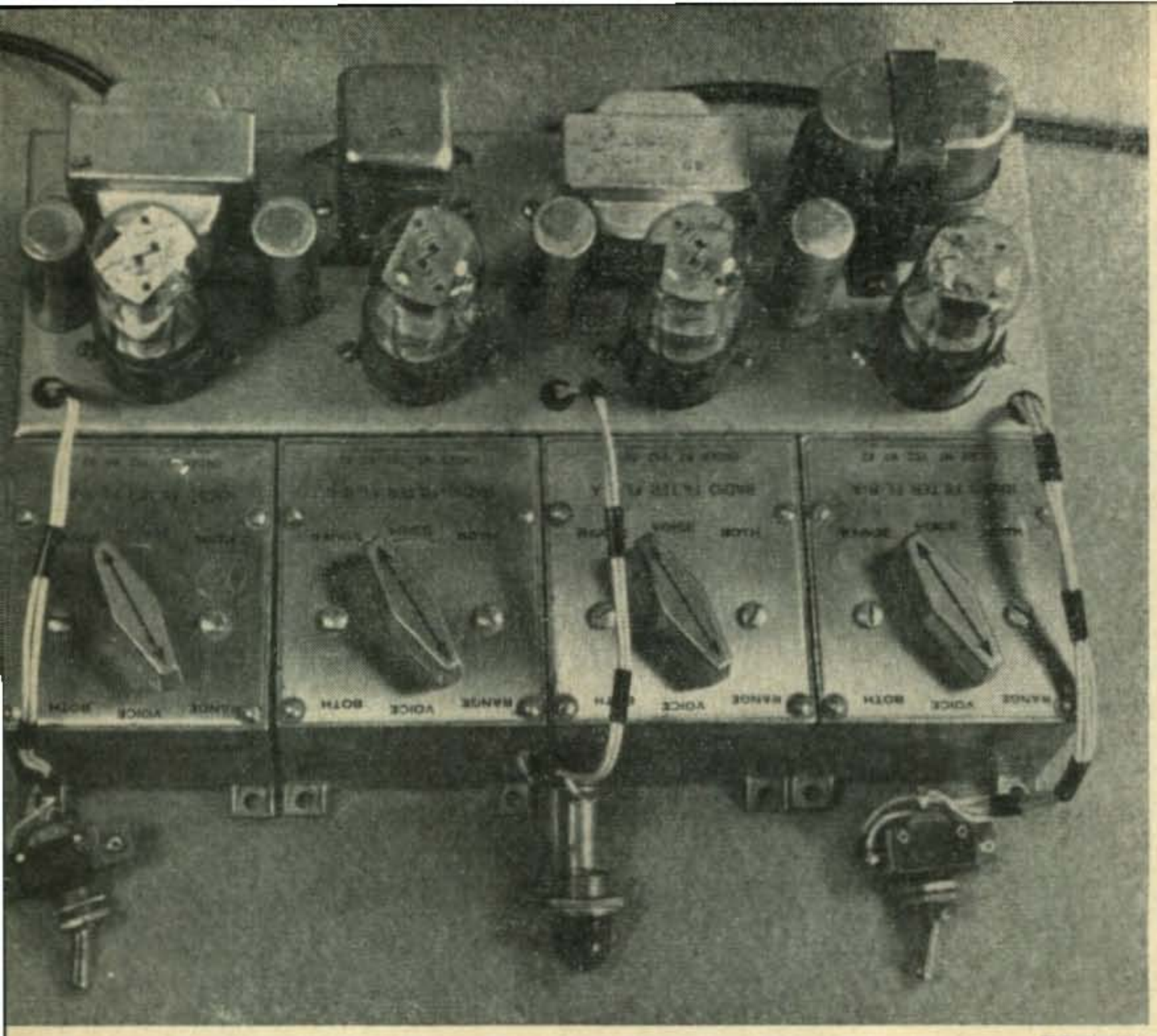


Fig. 1. Value of the 1625 screen grid resistors are 470 ohms, the input voltage should read 1500 volts *not 1200*. The 1625 cathode to 6AC7 grid condenser is .1 *not 1 mf*. The bottom voltage regulator tube is an OA2 *not* OB2.



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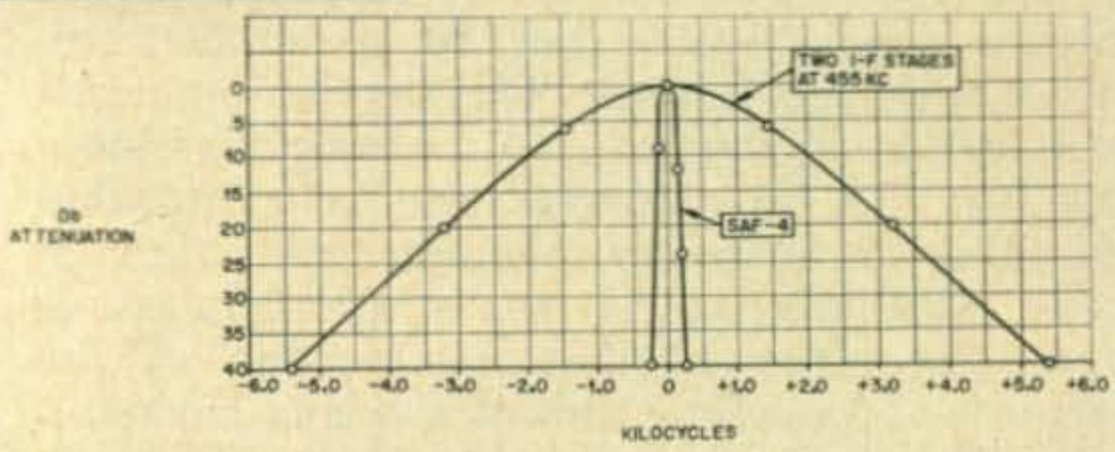
The works before being placed in the cabinet. The power supply components are mounted in a line along the back of the chassis.

Cost List for SAF-4

28	1/2 watt resistors	$2.80
5	.01 ufd. mica or ceramic capacitors	.75
4	1 ufd. at 200 volts	2.40
4	F1-8 Filters	5.30
4	6SL7 tubes	6.24
4	Octal tube sockets	.36
1	Chassis	1.25
1	dpdt toggle switch	.89
	Total	$19.99

Twenty Times the Selectivity for Twenty Bucks



SAF-4—

The C.W. Man's QRM Eliminator

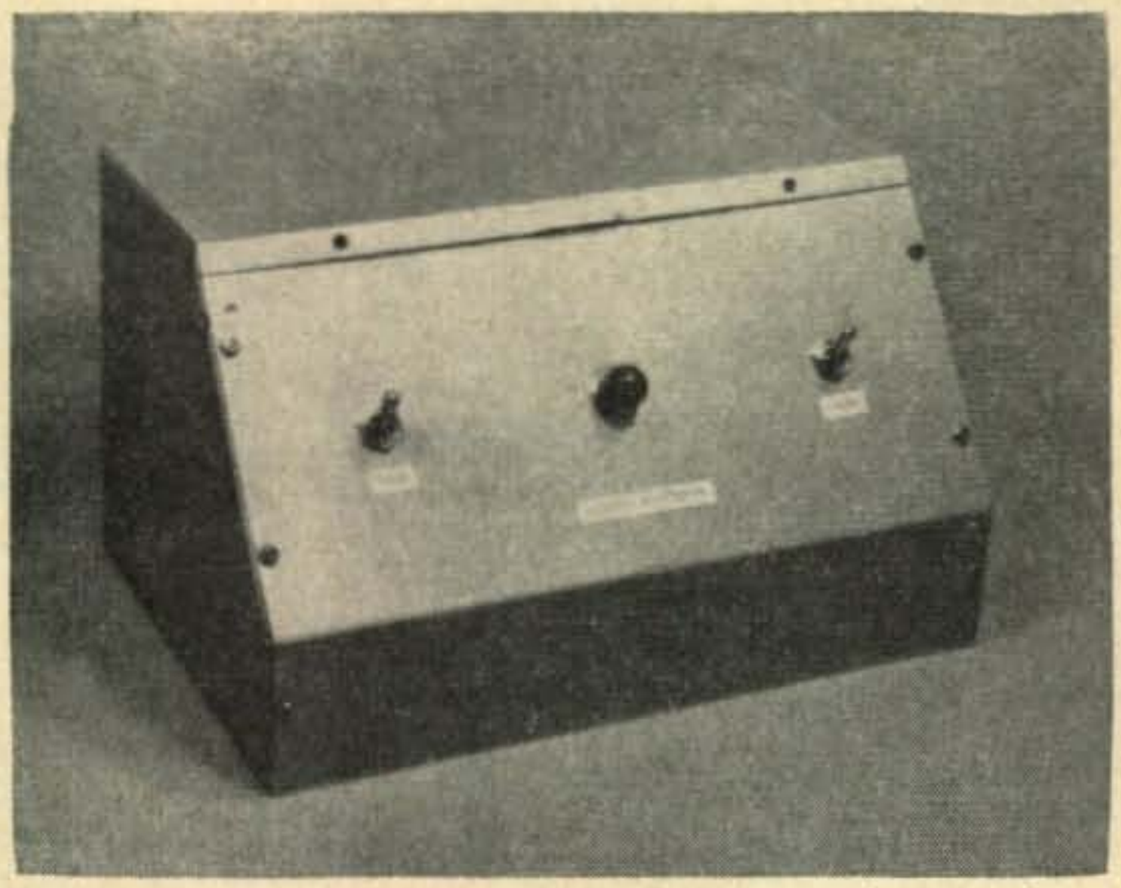
If you have never been bothered by QRM in the c-w bands, this is not the article for you. If you have ever tried unsuccessfully to dig a weak c-w signal out of a mess of QRM whistles, then read on. The letters SAF stand for *selective audio filter* and the number *4* means that four FL-8 filters are used in cascade. The apparatus described is an easy-to-build, inexpensive audio filter that will give your receiver selectivity second to none. The selectivity curve has a shape closely approaching the ideal square shape. The band width at the 6 db. attenuation point is 160 cycles and at the 60 db. point the band width is only 400 cycles. This means that the filter is about 20 times as selective as a receiver having two i-f stages at 455 kc. Instead of hearing 20 c-w signals all at once, you can listen to them one at a time. In addition to throwing our 19 QRMing stations out the window, about 19/20 of the background noise will disappear too. Another way to look at the situation would be to say that a 50 kc Novice band will seem 1000 kc wide. Between the 6 db. and the 60 db. attenuation points, signals fall off at a rate of about 1 db. for every 2 *cycles* change in frequency. That is mighty fast. In effect, as one tunes across a signal, the signal is either in the pass band or it isn't.

The filter is constructed out of readily available components, and the circuitry is extremely straightforward. Another advantage is that this filter requires no changes in your present receiver. A plug from the filter is inserted into the phone jack on your receiver, and earphones are plugged into the phone jack on the SAF-4. If you want loudspeaker reception the output can be fed back to your receiver's audio system, but this is not necessary.

The filter is easier and quicker to make than the average two-tube transmitter or receiver. I say this particularly to encourage Novices to try their hand at this filter, for if anyone needs a selective receiver it is the Novice. There is nothing to align, adjust, or to drift out of alignment; just wire it up, turn on the power, and there is your selectivity. The circuit diagram looks more complicated than it actually is. The construction goes very rapidly because there are no r-f coils, variable condensers, or other parts difficult to mount or align. The only circuit elements used are carbon resistors and mica capacitors which for the most part mount directly between vari-

ous pins on the tube sockets. A look at the picture showing the underside of the chassis will show how relatively simple the construction job is.

The data given in Table 1 show how the selectivity of the SAF-4 compares with other highly selective systems. The SAF-4 has a narrower bandwidth and steeper sides to its selectivity curve than any of the systems shown in Table 1. It must be admitted, however, that the systems mentioned in Table 1 have one advantage not possessed by the SAF-4, and hat is their ability to eliminate the audio image. When using the SAF-4 you will hear a signal on both sides of zero beat unless your receiver has a crystal filter or some device for giving it a single-signal effect. With the high



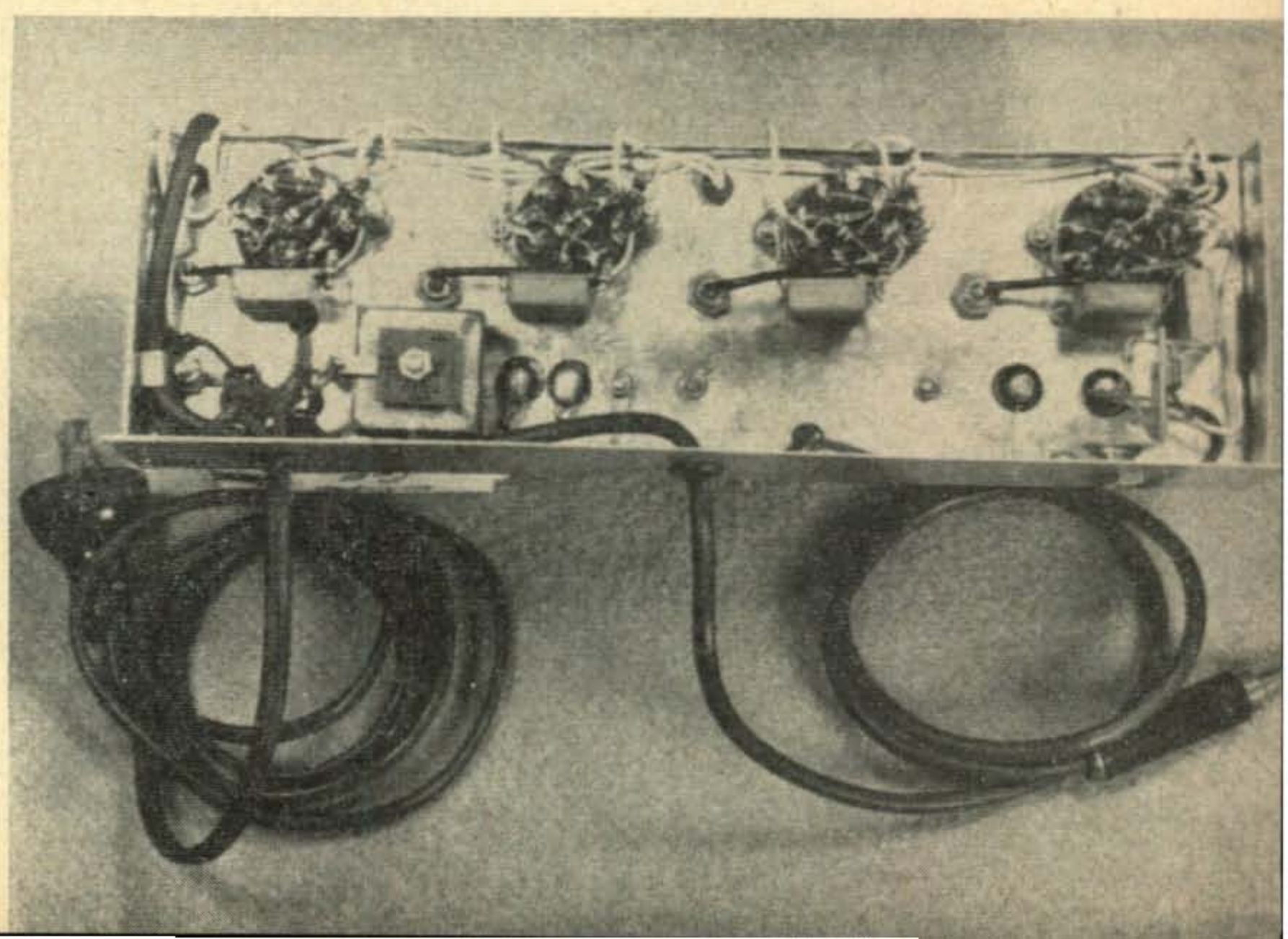
The SAF-4 in its cabinet. One toggle switch turns on the power; the other one switches the filter in and out.

degree of selectivity of the SAF-4, however, the audio image is of no great consequence. The filter can still make the 80-meter Novice band sound plenty empty even at 9 p.m. on a Saturday night.

You may wonder by now if such a selective filter will not make it difficult to tune in signals. Well, the ease with which you can tune in a signal with the SAF-4 depends upon how slow a tuning rate is available on your receiver. If you have a bandspread knob giving a frequency change of 5 to 10 kc per turn, you will find it fairly easy to tune in signals. The b-f-o pitch control is probably the most available bandspreader in most cases. If you are going to hold signals once they are tuned in, you will need a fairly stable receiver. If your receiver drifts a couple hundred cycles, the signal you are receiving may drift right out of the pass-band of the filter. But the stablity requirement is not so hard to meet as you might think. For example, I have found an 80-meter ARC-5 receiver to be entirely stable enough even with practically no warm-up, although its tuning rate is too rapid for comfort. It is surprising what a sufficiently long warm-up perod will do for receivers which tend to drift. Sometimes just lifting the cabinet lid will cut down the warm-up time by lowering the equilibrium temperature in the cabinet. If you have no difficulty tuning in and holding SSB transmissions on your receiver, you will have no trouble with this filter, because the stability and tuning rate requirements for the filter are considerably less demanding than those for SSB.

The heart of the unit is four FL-8 filters. Type L-8 filters have been available on the surplus market for several years at 1.00 to $2.00 each, and have been used as single units by hams to give considerable improvement in c-w selectivity. I presume FL-5 units would work just as well, but I have had no opportunity to try them. The FL-8 has often been used in impedance situations which did not bring out the best possible performance. When the FL-8 is used alone as a c-w filter, the signal is attenuated about 15 db in passing through the filter. Here the attenuation is compensated by the 6SL7 signal booster stages.

The FL-8 was originally made for use in aircraft to aid in receiving radio beacon sig-



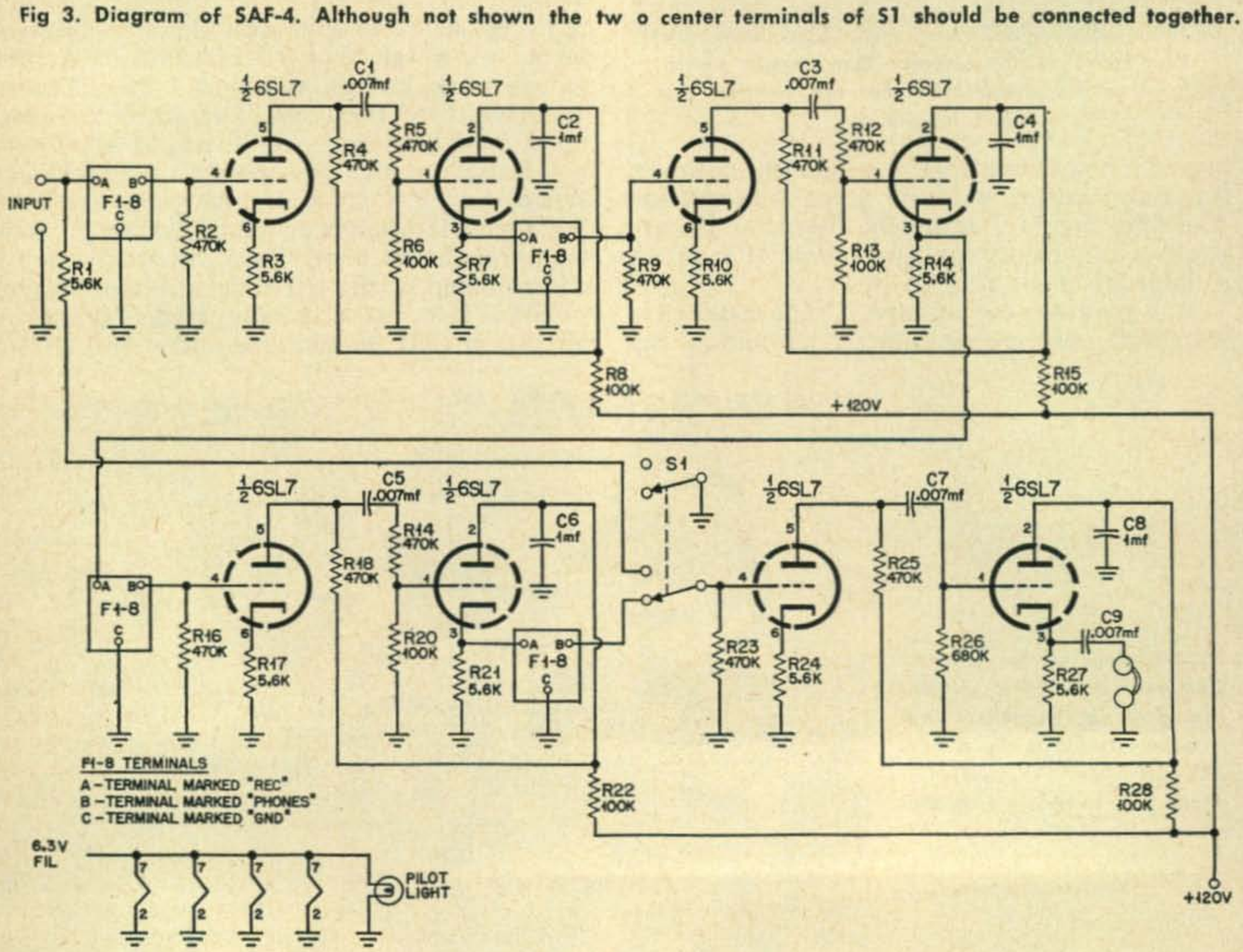
Bottom view of the chassis. One cord is for A-C power. The plug on the other cord is to be inserted in the phone jack of your receiver. A phone jack is mounted on the rear lip of the chassis.

nals. On the top of each unit is a switch bar-knob having three positions marked "Range," "Voice", and "Both". In the "Range" position, the FL-8 passes 1020 cycle signals and attenuates other audio frequencies, while in the "Voice" position frequencies in the neighborhood of 1020 cycles are greatly attenuated, and other audio frequencies are passed. In the "Both" position the filter is switched out and the incoming signal passes directly to the earphones. Radio beacon signals consist of tone-modulated c.w. and occasional voice modulation. The audio tone used is 1020 cycles. By switching to the "Range" position, an aircraft operator can receive the tone-modulated c.w. and reject any voice modulation. On switching to "Voice", the operator can receive the voice modulation and reject the tone-modulated c.w.

In the SAF-4 we will use only the "Range" position.

Looking at the circuit shown in fig 3, we see that each FL-8 unit is followed by a 6SL7 tube. The type 6SL7 tube was chosen because of its high amplification factor and low plate current (and because several 6SL7 tubes were available). The high amplification factor is not needed in the amplifier stages but is a desirable feature in the cathode follower stages The first half of the 6SL7 is used as a triode audio amplifier and the second half as a cathode follower. No cathode by-pass condenser is used because we do not need the additional gain the cathode resistor would provide. The amplifier plate is resistance coupled to the grid of the cathode follower stage. The grid of the cathode follower is tapped down on its grid resistor so that the signal voltage at 1020 cycles at the grid of the cathode follower is about the same as that being applied to the preceding FL-8. The use of a cathode follower as a coupler between the 6SL7 amplifier and the succeeding FL-8 filter is not absolutely necessary, but its use does give a higher order of selectivity per FL-8 stage. The reason for this is that the input impedance of the FL-8 varies with frequency, unfortunately being less at 1020 cycles than at any other frequency. If the FL-8 filter is being driven by a voltage source having a high internal resistance (such as the plate of a 6SL7), it will "load down" the voltage source more at 1020 cycles than at any other frequency, with the result that the voltage input across the FL-8 is dragged down at 1020 cycles thus cutting down the selectivity. Measurements show that feeding an FL-8 with a high impedance source causes about 6 db. loss at the peak frequency as compared to the case when the FL-8 is fed with a low impedance source, while at frequencies away from the resonant frequencies there is no such loss. This situation is illustrated in fig.

Fig 3. Diagram of SAF-4. Although not shown the tw o center terminals of S1 should be connected together.



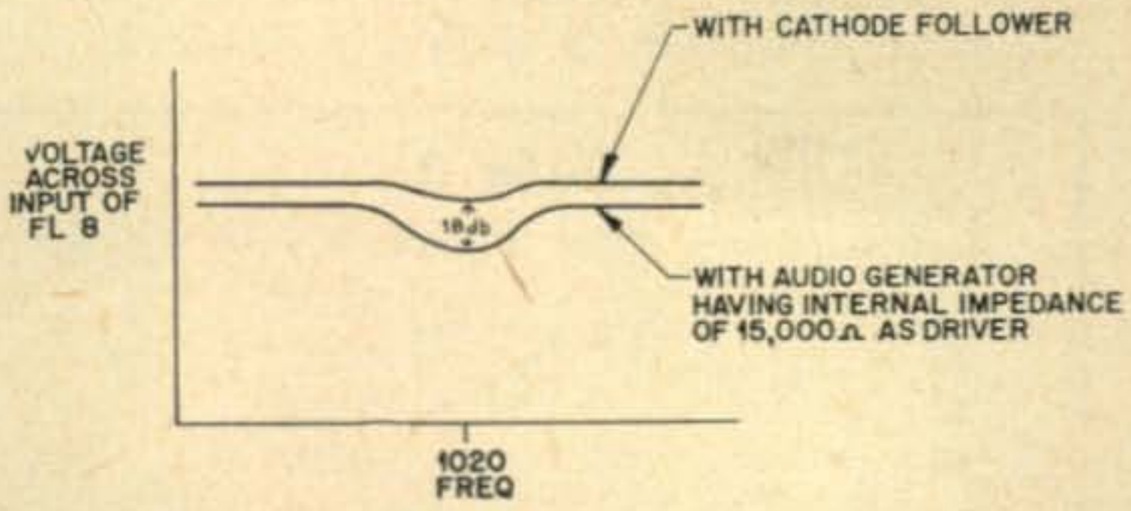


Fig 1 Cathode follower response curve. The 18db dip should only read 6db.

1. You can see that better selectivity will be secured if the frequency desired to pass through the filter is able to maintain the same voltage across the FL-8 as any other frequency. The cathode follower has a gain of slightly less than one ((0.89 in our case), but it does have a low internal impedance, and it is for this reason that it is used. The internal impedance of our 6SL7 cathode follower can be estimated from the formula

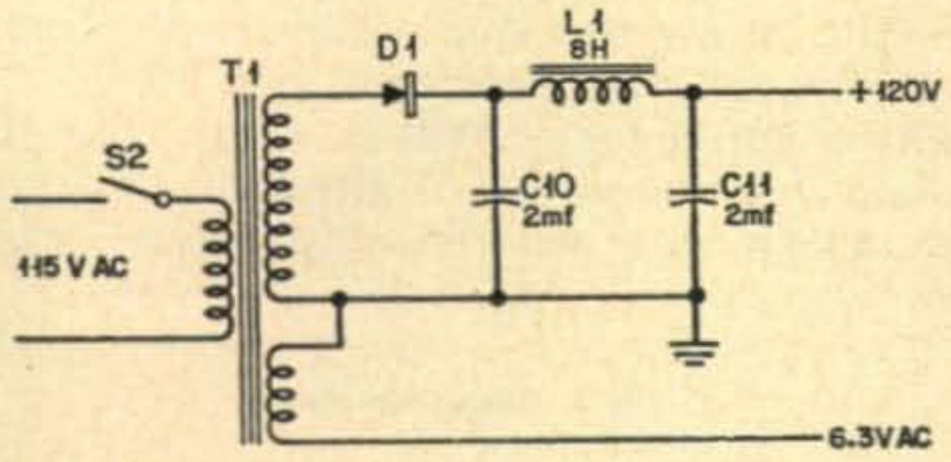
$$Z = \frac{r_P R_K}{r_P + (1+u) R_K}$$

to be of the order of 1000 ohms. This is a considerable improvement over the straight amplifier section which probably has an internal resistance of the order of 100,000 ohms at the point at which we are operating. One could replace the twin triode amplifier-cathode follower combination with a single triode havig a low plate resistance, but the simplificaton in circuitry would be paid for by a greatly increased plate current drain, and the plate resistance would probably not be as low as 100 ohms thus decreasing the selectivity somewhat. The decrease in selectivity could be made up of course by adding another FL-8 section. If you want to play around with circuit changes, you're welcome.

The amplifier section in the last 6SL7 is run wide open, that is, its grid is connected to the top of its grid resistor to give full voltage input. The second half of this 6SL7 is also connected as a cathode follower to match the impedance of earphones. The advantage of a cathode follower here is demonstrated by the following figures. In a typical case .006 volt of audio was developed across the earphones when coupled through a capacitor to the plate of the amplifier, but when the earphones were connected to the cathode follower .040 volt was measured. So we see that even though the cathode follower is a no-gain device, it can give an increase in tthe voltage developed across a load (a factor of almost 17 db in the case above) by virtue of its impedance-matching ability. The phones used were of the high impedance type. The signal level is held down to prevent overloading the amplifier stages. Severe overloading can generate audio harmonics which then would have to be filtered out, or a strong signal with an audio beat frequency of 510 cycles, for example, could generate some 1020 cycle second harmonic audio if one of the amplifiers were being driven too hard. This condition can be avoided by holding the signals to a moderate level while going through the FL-8 filters and preceding amplifiers and then boosting the signal level after the last filter. The fact that our last 6SL7 runs wide open will insure a reasonable moderate signal level through the filters and their amplifiers. The last 6SL7 has sufficient gain so that overall gain of the SAF-4 is 20 db.

	Bandwidth in Cycles	
	6 db down	60 db down
SAF - 4	160	400
Crystal Filter at 455 KC	250	10,000
50 KC i-f strip with 11 high-Q tuned circuits	350	1,300
Mechanical C-W Filter	800	2,500
Q Multiplier at 455 KC	375	15,000 (Estimated)

Table 1 Selectivity curve comparison chart.



Power Supply Diagram

Parts List for SAF-4

C1, C3, C5, C7, C9 -- .007 ufd. mica (any capacitor having a value of 1.0 ufd. or greater and a voltage rating of 150 volts or greater will be satisfactory.)

R1, R3, R7, R10, R14, R17, R21, R24, R27 - 5.6 K, 1/2 watt R2, R4, R5, R9, R11, R12, R16, R18, R19, R23, R25 - 470 K, 1/2 watt

R6, R8, R13, R15, R20, R22, R28 - 100 K, 1/2 watt

R26 - 680 K, 1/2 watt

F1, F2, F3, F4 - Fl-8 filters

S1 - dpdt toggle switch

Power Supply

S2 - spst toggle switch

T1 - Power transformer, H.V. secondary 115 volts at 30 ma., 6.3 volts at 1.2 amp.

D1 - Selenium rectifier, 20 ma.

L1 - Filter choke, 8 henries at 25 ma. (A 10 K, 1/2 watt resistor may be substituted if desired.)

C10, C11 - Filter capacitors, 2 mfd. at 600 volts. (Any capacitor having a value of 2 mfd. or greater and a voltage rating of 150 volts or greater may be used.)

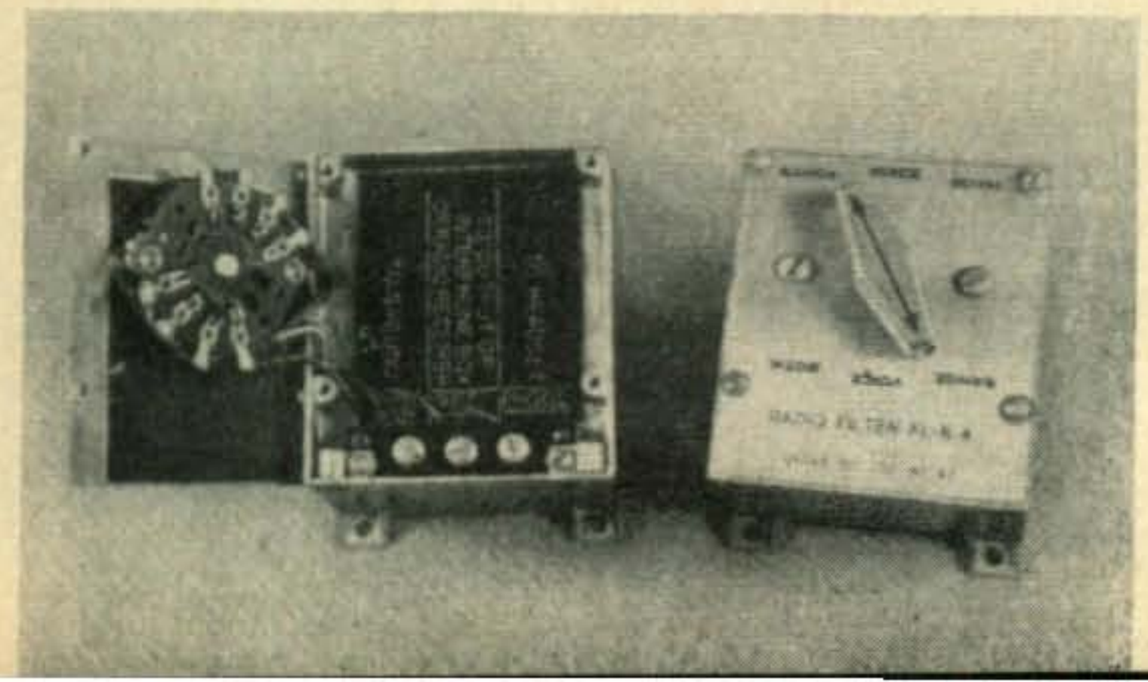
The circuit includes a small power supply. If desired, however, the necessary power could be robbed from your receiver since the unit requires only 1 ma. at 120 volts and 1.2 amp. at 6.3 volts. The current-limiting resistor of 25 to 100 ohms usually used with selenium rectifiers was omitted since the high voltage secondary winding of the small transformer used had a resistance of 100 ohms. Since the current required is only 1 ma., it would have been more economical to have used a 10 K resistor instead of the filter choke. The filter capacitors are 2 mfd surplus oil-filled jobs rated at 600 volts. Any filter capacitor having a capacity of 2 mfd or greater and voltage

ratings of 150 volts or greater could be used. Good quality electrolytic capacitors will of course work just as well as oil-filled ones, but with the low prices at which surplus oil-filled capacitors are now available, it is not a bad idea to take advantage of their superior qualities.

The placement of the parts is not at all critical, except that the output of each stage should be kept isolated from previous stages to prevent undesired audio frequencies from leaking around the FL-8 filters through stray capacitive coupling. The 1 mfd capacitors connected to the plates of the cathode follower triodes serve two functions. First they serve as the audio by-pass from plate to chassis for the cathode follower stages. They also function with the 100 K resistors in the B+ leads (R^{28}, R^{8}, R^{15}, and R^{22} in fig 3) to form decoupling circuits to remove the audio signal from the B+ line. After the audio frequency current from the plate of an amplifier tube (pin 5) flows through the 470 K plate resistor, it faces a choice. It can get to the chassis either by flowing through the 100 K resistor and the 2 mfd capacitor in the power supply, or by the alternate route through the 1 mfd capacitor to the chassis. The impedance of the 1 mfd capacitor at 1000 cycles is about 160 ohms. Since this 160 ohms is much less than the slightly greater than 100,000 ohms by the other route, most of the audio current (99.84%) flows through the 1 mfd. capacitor to the chassis, and only a very little audio current flows through common B+ leads and the power supply. If the audio signal current from all stages had been allowed to flow on the common B+ lines and through the power supply, there would be the possibility of signals getting through our system without going through the string of FL-8s with resulting loss of selectivity. Also it might suffer from feedback troubles.

Why did I decide to use four FL-8 units and not three, five, or some other number? Well, I thought four units would give me about the maximum result with minimum effort, and perhaps more important, four units just exactly fitted into an available cabinet. If you look at the selectivity curves shown in *fig 2* for one, two, three, and four stages, you will see that the amount of improvement per stage has become rather small by the time four stages are being used, although additional stages could still add a little to the selectivity.

Two FI-8 units, one with the top cover opened up.



That my four FL-8 units do not all peak at the same frequency is shown in Table 2.

Table 2

FL-8	*Peak Frequency in Cycles*
#1	1010
#2	1090
#3	1120
#4	1075

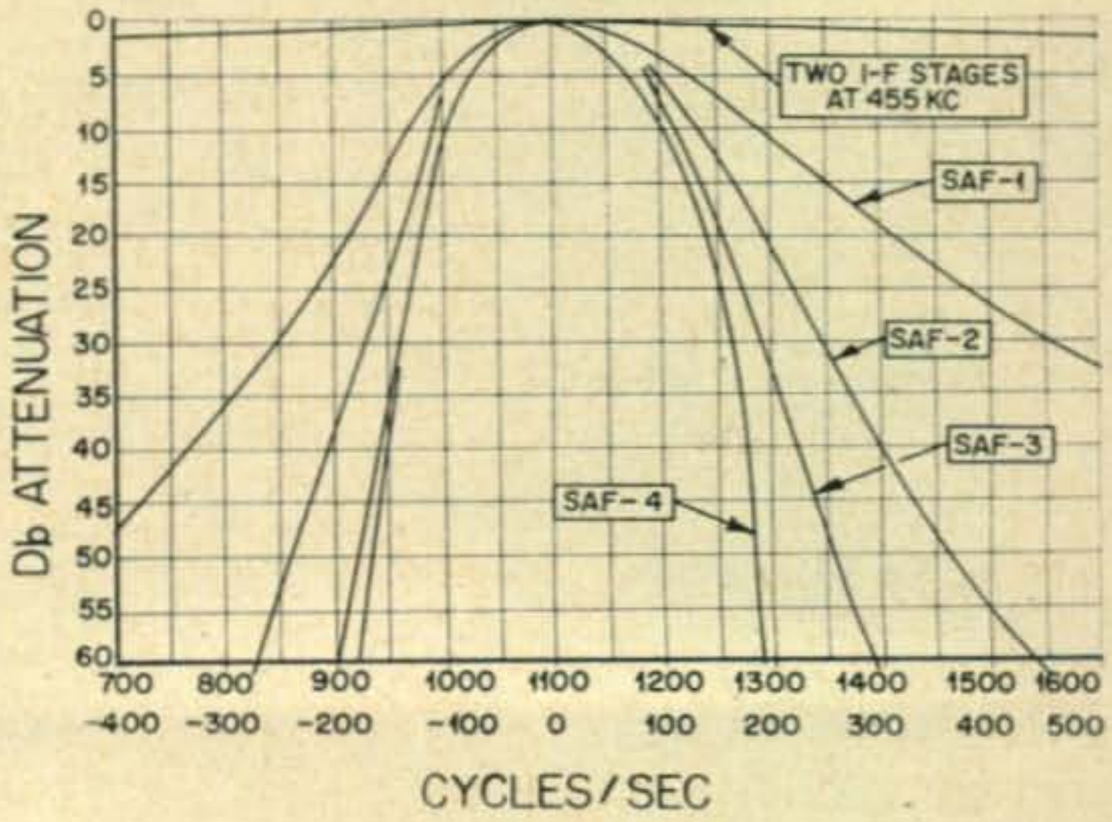
From the data shown in Table 2, it can be seen that my filter system is somewhat stagger-tuned. In my opinion, this stagger-tuning is all to the good because it makes the peak of the selectivity curve somewhat broader and its overall shape somewhat more rectangular; however, if you want a narrower peak, you should be able to get it by selecting your FL-8 units so that they all have more nearly the same peak frequency.

The switch S^1 cuts the filter in and out of the circuit. The gains of the amplifiers in the filter system have been adjusted so that at the resonant frequency the signal voltage is the same with switch S^1 in either position. With a QRM-free signal having a beat note of 1100 cycles, the only dfference observed when the filter is switched in is that the background noise decreases markedly. If the beat note is a couple hundred cycles or more above or below the magic number 1100, then the signal just disappears when the filter is switched in. This signal can again be made audible, if desired, by carefully adjusting the b-f-o pitch control to bring the beat note to the required 1100 cycles.

If the signal strength is not the same in your unit at the peak audio frequency with S^1 in either position, the signal levels can be equalized, if you want, by changing the value of R^{20}. Increasing its value will increase the signal level through the filter and vice versa.

Once you have heard how the SAF-4 can transform a messy QRM situation into a solid copy QSO, you will be sold on it. Enough said. ■

Fig 2. Response curve.



Further Notes on the TNS

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After reading the April CQ article on how to get the TNS into a '57 Chevrolet printed circuit radio, I decided to try my luck on the '56 Chevrolet I got last year. Last year the car was too new to be able to get a circuit diagram for the B.C. set and so I had to wire the TNS in as best I could in a logical part of the circuit. I wired it in series with the second detector output lead and it did a reasonable job of noise suppression. However, it also resulted in a terrific loss of audio gain and very heavy distortion. I could read the boys on ten with it so I decided to let it go at that. After reading the article on how to put it into a '57 Chevvy radio, I decided to renew efforts to get it working right in my '56 once and for all. I pulled it out of the dash (for about the 500th time) and proceeded to hook it up as per the instructions given by the article. It worked but not much better than before. I then got a copy of the circuit diagram and it showed a vast difference between the second detector-first audio stage of the '56 and that of the '57. Looking at fig. 1 see that in the system in the '56 second detector-first audio the cathode is well above ground and is hooked up in such a way as to form a negative feedback loop with the grid. After seeing this, I decided that the addition of the TNS had unbalanced the whole system and thus caused my distortion. I also noticed that in my original installation just after I got the car, just plugging in the squelch tube raised my noise level considerably. Under these circumstances, the squelch didn't work at all. After analyzing this situation, I came up with the following procedure to get this thing going and working right. All I really did was to change the '56 second detector-first audio stage to the conventional circuit of '57. I started by clipping out from the tube side of the board, the 820 K. resistor. This was followed by the removal of the 1.8 K. resistor by merely clipping it out from the tube side of the board. Then I grounded the cathode directly to the ground pin in the center of the 12BF6 socket on the printed side of the board. At this same point I connected the TNS ground lead. Then I unsoldered the 2.2K resistor from the board and replaced it with a 4.7 meg. resistor. After that I similarly removed the larger (physically) of the two 47 K resistors and replaced it with a 220 K resistor. This is the plate load resistor. Finally, I found the point where the smaller 47 K i-f decoupling resistor joined the 68 mmfd

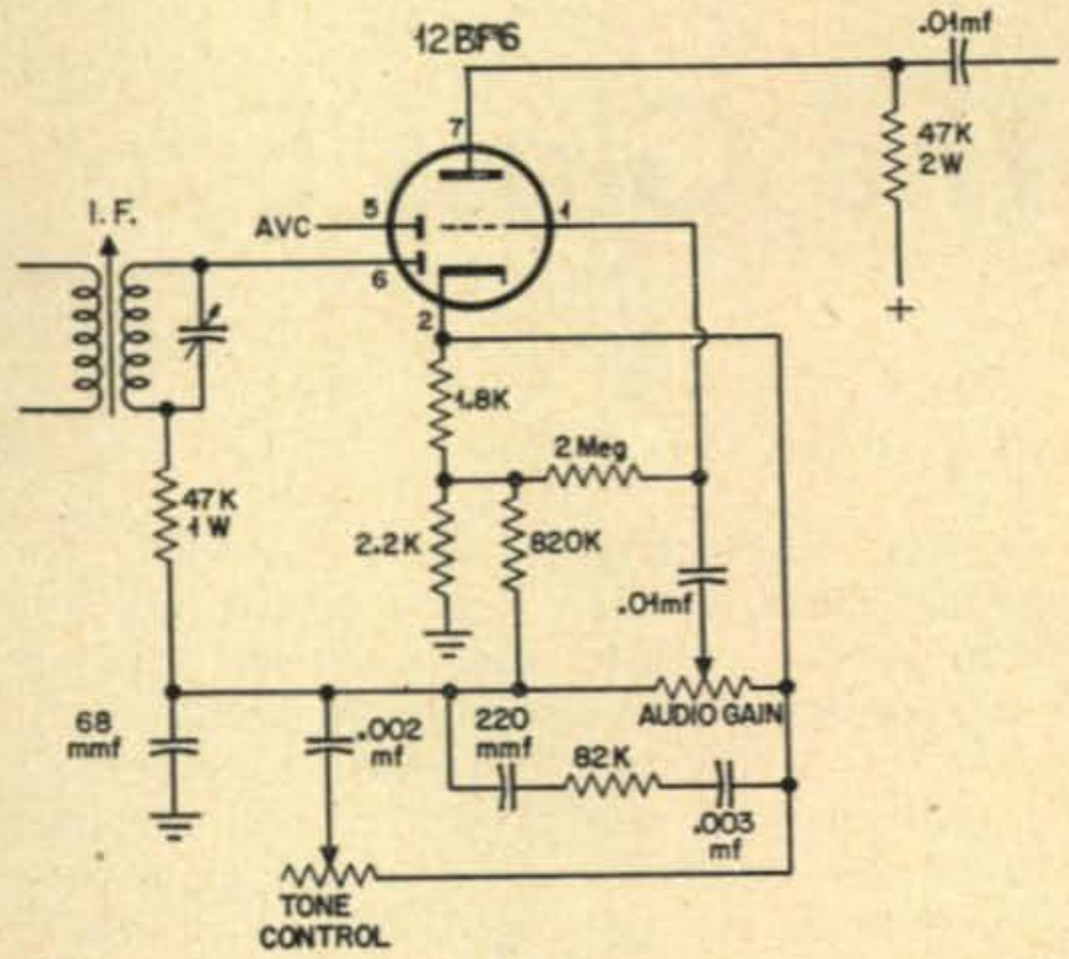
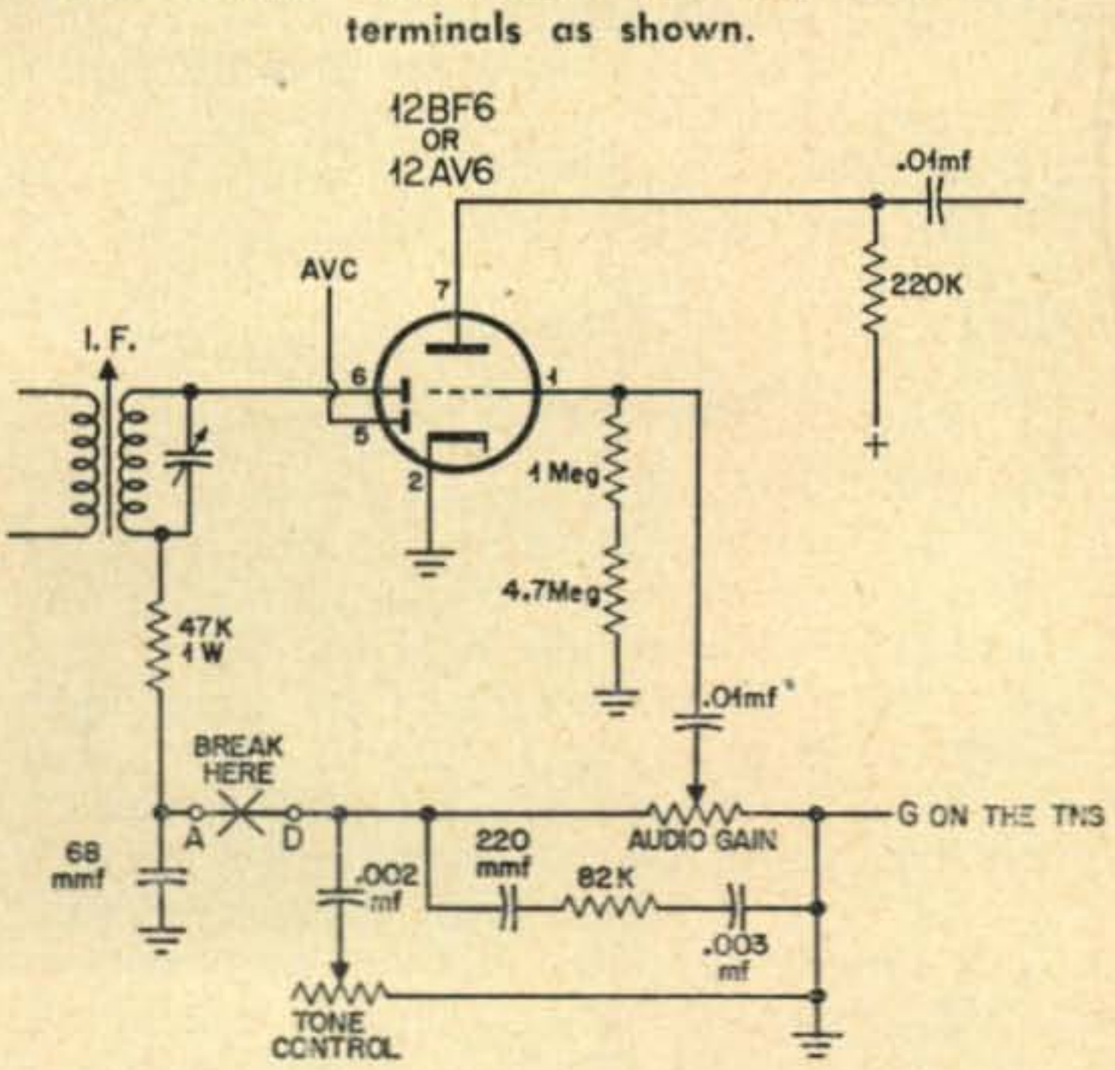


Fig 1. Original circuit of the second detector first audio stage of the '56 Chevy.

Fig 2. Circuit modified to accommodate the TNS. Break the line between the 47K resistor and the tone control and connect the TNS A and B terminals as shown.



silvered mica capacitor. I broke the lead from this point to the .002 tone control capacitor and hooked the TNS in as shown in the revised circuit of fig 2.

The B plus and filament leads can be hooked up at any convenient point and there should be a separate and direct ground lead from the TNS chassis to the B.C. set chassis.

After making these modifications, I had wonderful results. The squelch works like a charm as does the noise limiter. There is still a slight loss in gain as there is with any such limiter but not a trace of distortion. ■

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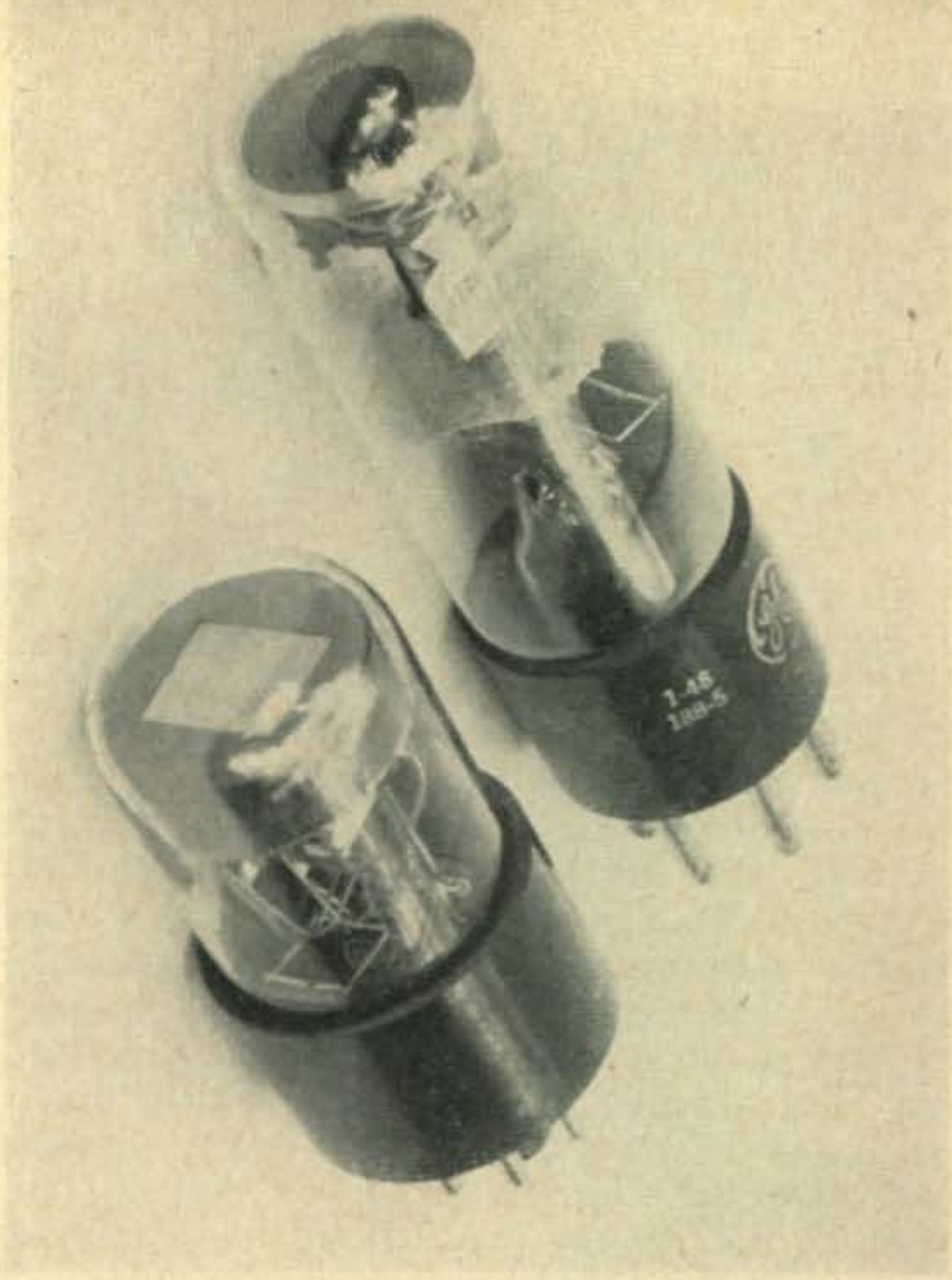
The Glass Eye



No, The Glass Eye is not a substitute for an ocular gland. Rather, it is a novel indicator for tuning the various stages of an amateur transmitter without switching. In addition, it incorporates a feature for giving an approximate indication of modulation percentage. Because of its small size (less cubic area than a three inch meter), it is ideal for use in miniature transmitters for both home and mobile use.

Actually, the whole project came about as the result of a mistake. It was discovered while unpacking an order of replacement television tubes. Checking the packing slip against the want list, I found that I had made a mistake and ordered a 6AL7 rather than the 6AL5 that I really wanted. Since it was my error I could not return the tube. Quite naturally I did what any red blooded ham would do, I built a rig around it.

Magic Eye Tubes

The 6AL7 belongs to the family of so called "magic eye" tubes. Possibly, at one time or another, you have seen a radio that used one of these tubes. Somewhere near the tuning dial was located a fluorescent circle of green light that served as a tuning indicator. More than likely this was one of the 6E5/6U5 type of "magic eye" tubes, as these were quite popular before the Second World War. When the radio was not tuned on a station there appeared in the green circle of light a dark wedge about 90° wide. Whenever one tuned the radio on a station, the wedge would get narrower. On an extremely strong station the dark wedge would completely disappear, producing a complete circle of green light. The stronger the station, the more the wedge would close. In effect, this gave the set owner an indication of when the set was correctly tuned and approximately how strong the signal was. *Fig. 1* shows the various patterns that are produced on the face of this tube with different signal conditions.

Technically, you might consider the 6U5/6E5 as a combination d-c amplifier and cathode ray tube. As you can see from *fig. 2* the lower end of the tube is just about the same as any other triode. In this tube, however, the cathode extends up beyond the grid and plate structure. The cathode emits electrons that are allowed to strike the target. To produce the light, the target is coated with fluorescent powder that emits a green light when excited by electron bombardment. Between the target and the cathode is a control rod that is an extension of the triode plate and it is this rod that controls the flow of electrons to the target. When

Fig 1

the grid of the triode has zero volts on it, the tube will conduct strongly. This causes the plate voltage (which flows through a one megohm resistor) to drop to a very low value. The target is connected to a source of B plus voltage but the anode rod (which is now less positive than the target) acts as if it were a "grid" to stop the flow of electrons to the target. Because the electrons never reach the target it produces the dark wedge, or shadow. But what happens when a strong station is tuned in on the radio? The station will cause a negative voltage to develop in a circuit that

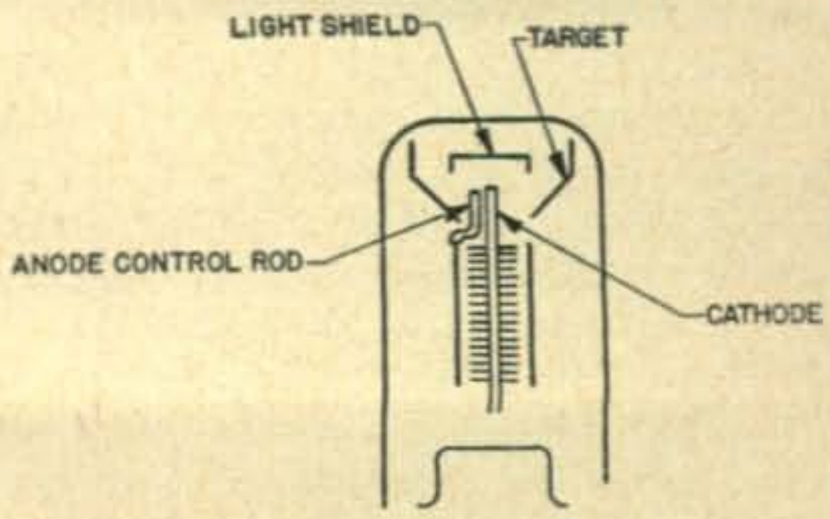


Fig 2

is known as the *automatic volume control* circuit. This negative coltage is applied to the grid of the triode section of the "magic eye" tube and as a result of this voltage, conduction in the tube drops to a very low value. As you have probably guessed the plate voltage under these conditions is quite high. As a result of this action, the control rod (which is connected to the plate) is now somewhere near the same potential as the target, thereby allowing electrons to flow to the target, which closes the wedge.

Naturally, these two examples are extremes, but generally speaking the negative grid voltage will determine the amount of "eye closure". For a typical application (with 250 volts B plus) zero grid volts will produce a 90° wedge and -7.5 volts will completely close the "eye". *Fig. 3* is a schematic diagram of a typical circuit for

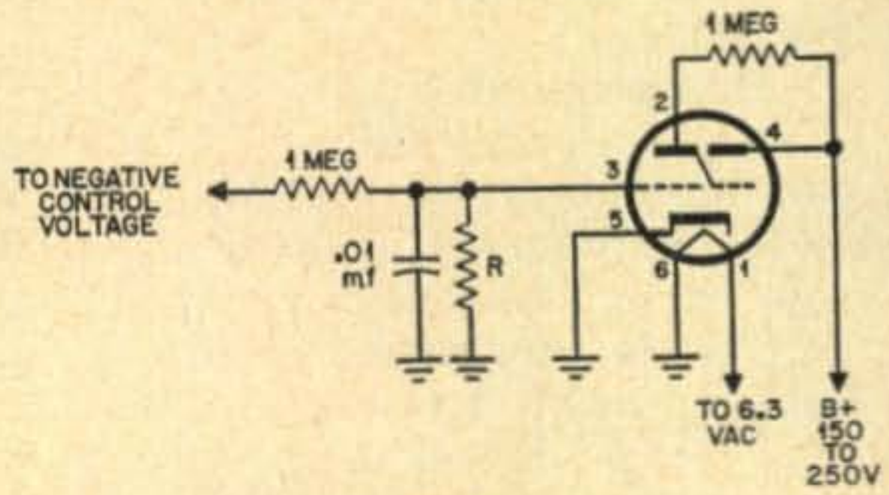


Fig 3

use with the 6E5/6U5 series. The resistor and capacitor in the grid circuit is a filter network to prevent any a-c signal from reaching the grid of the tube. This condition is undesirable because it would cause a fuzzy edge as the result of the pattern alternating back and forth. This circuit can be used in any application when one might want to "meter" the amount of negative voltage available in a circuit. The wedge angle could be calibrated on a scale, against a known source of voltage, and the "eye" could be used as a "true vacuum tube voltmeter". You could not "pin" the pointer on that one!

Undoubtedly you can think of many other applications for this tube. It could be switched to the various grids of a multistage transmitter to measure the amount of grid drive. The *Gonset Company* did this quite some time ago in their Communicators. In this application, as the drive from the preceding stage increases, the grid of the tube being measured will develop more self bias. This voltage, applied to the control element of the "eye" tube, will cause maximum closing of the eye when the stage is correctly tuned. Unfortunately this tube has to be switched into the various circuits, the 6AL7 does not.

The 6AL7 "Magic Eye" Tube

The need for the 6AL7 was brought about because of the difficulty of tuning some of the earlier television sets and a-m and f-m radios. Certain models of these sets had a plus-zero-minus voltage available rather than the negative automatic gain control voltage. Obviously, you could not apply a positive voltage to the 6E5/6U5 tube, so a new one had to be invented. Its operation is similar to the 6E5/6U5, but the face display is altogether different. The 6AL7 has two movable green bars rather than the green circle and wedge. Instead of one control element, the 6AL7 has three. You might think of the top of each bar as being connected to a pin in the socket of the tube. Connecting a negative voltage to this pin will cause the bar to move down. Connecting a positive voltage to the same point will cause the bar to move up. The third control element causes the bottom of both bars to move up. This element is usually actuated by a negative voltage. In television or f-m receivers, the electrode for the left bar was usually grounded as a zero volts reference. The right bar was controlled by the plus-zero-minus voltage derived from the discriminator. When approaching a station, the bar might move up, then come down even with the reference bar, and then move below the reference bar. When the two bars were even, it indicated correct tuning because of zero volts out of the discriminator. The electrode for the bottom of the bars was usually connected to the a-m portion of the receiver as a regular tuning indicator. In some cases it was used in conjunction with limiter

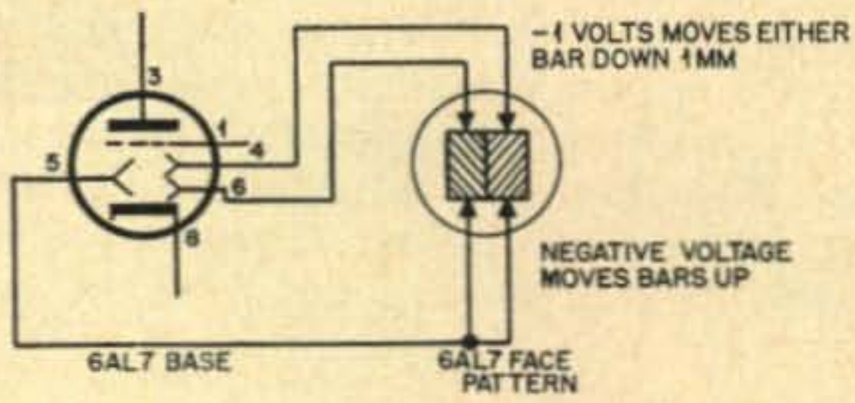


Fig 4

as an indication of signal strength. *Fig. 4* shows the electrode functions of the 6AL7 tube. According to the RCA tube handbook, the 6AL7 can be mounted in any position. It has a maximum length of 3-1/16 inches and a maximum diameter of 1-9/32 inches. The maximum target voltage is 365 volts but the tube should have a minimum target voltage of 220 for an acceptable display. The deflection sensitivity is approximately 1 mm./volt.

Using The 6AL7

That rig that I spoke of earlier was the transmitter portion of an SCR-522. Anyone who has ever tried to tune up that monster will understand why "The Glass Eye" was incorporated in it. Unlike the meter that one usually tunes the transmitter with, The Glass Eye allows you to see what is going on in the

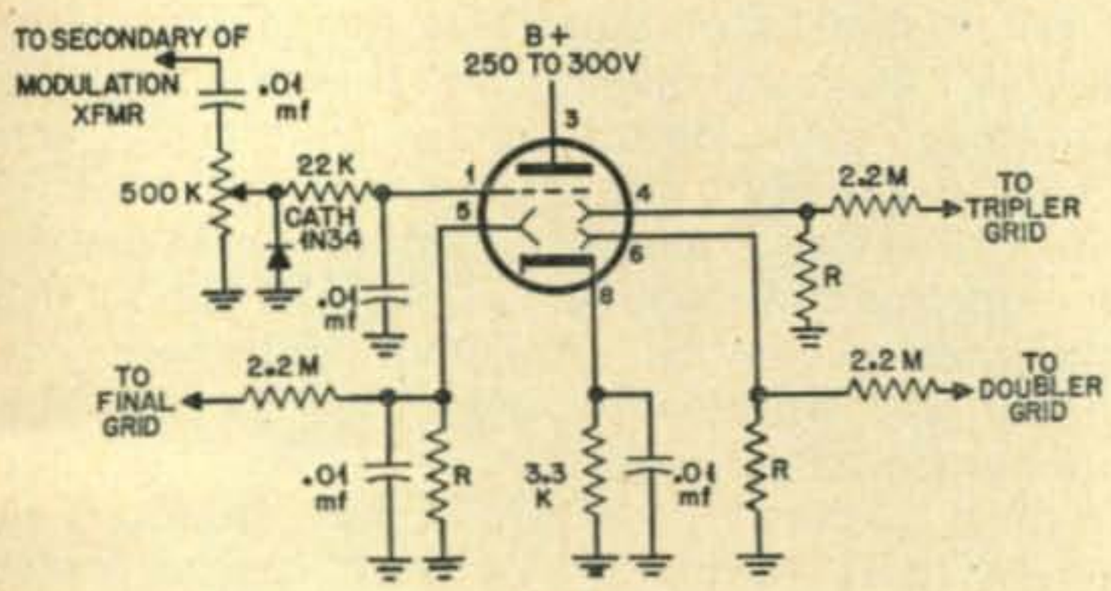


Fig 5

next stage even before you get there! The mounting hole was cut in the 522 front panel just above the crystal socket (steel panel—what a job!) and the socket was mounted back from the panel on 1½ inch spacers. Next, the circuit shown in *Fig. 5* was wired into the 522. This particular 522 did not use the conversion that requires the negative bias supply. If your rig uses such a supply, the grids of the various tubes will have a fixed potential of –150 (approx.) and it will probably be necessary to return the grounded connections in *Fig. 5* to the bias supply.

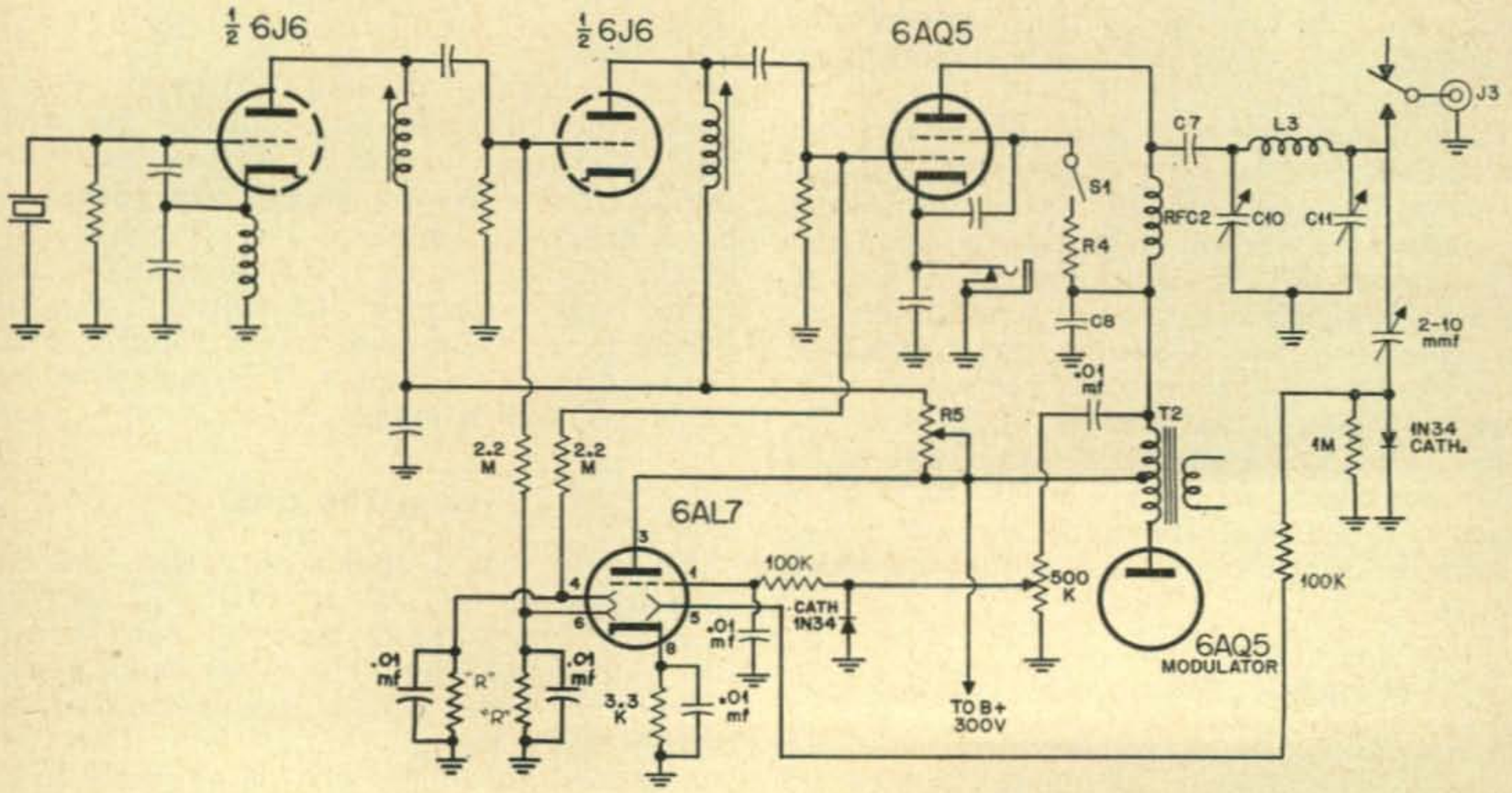
At this point, a word about the resistors labeled "R" in *Fig. 5* is in order. These resistors are used to adjust the deflection sensitivity of the circuit associated with each deflection electrode. Because some transmitters will develop low values of bias while others will be quite high, it is impossible to give exact values for this resistor. The value of this resistor should be changed until the pattern does not go off the screen under maximum drive conditions. The same adjustment applies to the 6E5/6U5. Resistor R in *Fig. 3* is adjusted to prevent the pattern from overlapping. Obviously if more that 7.5 volts is applied to this tube the pattern will close or overlap and it would be impossible to determine at what point maximum drive occurred. As an example, the 6E5/6U5 requires -7.5 volts to close the pattern. The full grid voltage of your transmitter might be 100 volts or more and it would cause the eye to close and stay closed. Therefore, it is necessary to add resistor R which, with the 1 megohm resistor, forms a voltage divider. The value of *R* would be reduced until you obtained less than –7.5 volts on the control electrode under maximum drive conditions. Then, if the drive was reduced from maximum, the eye would open proportionally. It is convenient to use a 1 megohm pot and to adjust it until the "eye" is about 2/3 closed with maximum drive. Then remove the pot, measure it and replace it with a fixed resistor near the same value. Typical values for *R* will be between 47K and 470K. This same adjustment procedure applies to the 6AL7 tube and the typical values for *R* will be about the same.

The 2.2 megohm resistors (in *Fig. 5*) are used for isolation of r-f voltages in addition to being part of the voltage divider. These resistors should be mounted as near the grid, of the stage being checked, as possible. This will minimize the amount of r-f that "escapes" when making these connections. The length of the lead should be no longer than ⅜ inch, with ¼ inch preferred. The other end of the resistor (which should be secured with a tie-point) is connected to the control electrode of the tube. The length of this lead is not critical.

Although The Glass Eye is a pretty handy gadget, its usefulness can be increased by utilizing the control grid characteristic. As with other tubes, when we make the grid more negative, less electrons will flow in the tube.

[*Continued on page 179*]

Fig. 6



Multi-Band Vertical

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For the amateur who can sit back and leisurely describe his antennas as separate beams for 40, 20, 15, and 10 or perhaps one of those new Flognocker-Skysocker multi-band beams, this article would be of little interest. However, for good old Joe's that feel variety is the spice of life, and therefore would like to work several bands, but are still dismayed at the rising cost of a ham—pardon the expression—sandwich, I hope this simple idea can be of benefit.

Throughout most of my amateur career I've been faced with the sorrowful realization that a 160 meter extended double Zepp won't fit on the average city lot. In fact, a 40 meter dipole usually has to be run diagonally from corner to corner so that at high noon the antenna's shadow is entirely within the amateur's sovereign domain.

When 40 meter verticals became the rage I followed suit and noted that they required fewer guy wires and less room than the old doublet. It loaded up nicely on 15 so I had two band coverage. When it appeared that the easiest way to enable operation on the other bands was to make the vertical an all band affair, I began researching the various methods used to date. Complicated switching and loading circuits were out. The vertical is located on the roof and I felt relays were more trouble than necessary. Loading coils would reduce the operating range of the antenna.

Recent articles (Berg, "Multiband Operation with Paralleled Dipoles," QST, July, 1956 and McCoy, "A Novice Three-Band Antenna System," QST, Feb., 1957) on paralleled dipoles held the answer. A quick bit of amateur legerdemain with some old nuts and bolts and a couple of pieces of tubing netted me a multi-band antenna—paralleled verticals—for operation on 40, 20, 15, and 10 meters.

The modification to multi-band operation was quite simple and required no actual alteration of the 40 meter vertical. As can be seen in *fig 1* I merely used the 40 meter antenna for a support and mounted 10 and 20 meter verticals to it. I used ⅜" aluminum tubing for the added elements but wire or almost any tubing could be used.

Spacing between the antennas is in no way critical and the only precaution is to provide fairly good insulation at all the horizontal

[*Continued on page 162*]

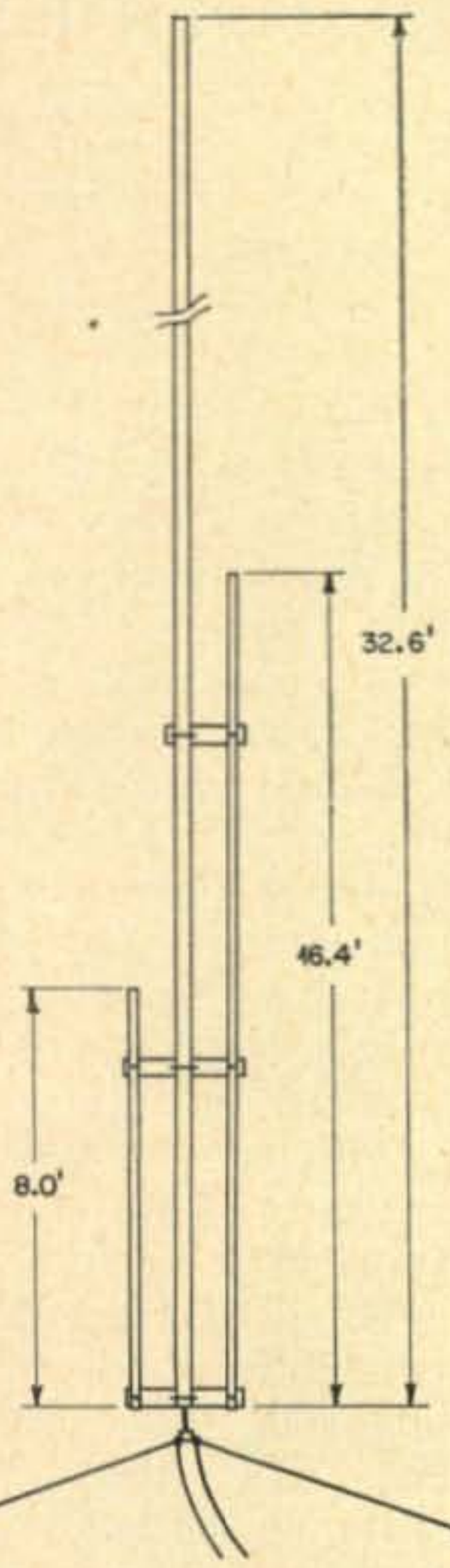

Fig 1. Method of mounting the two additional vertical elements to a 40 meter ground plane.

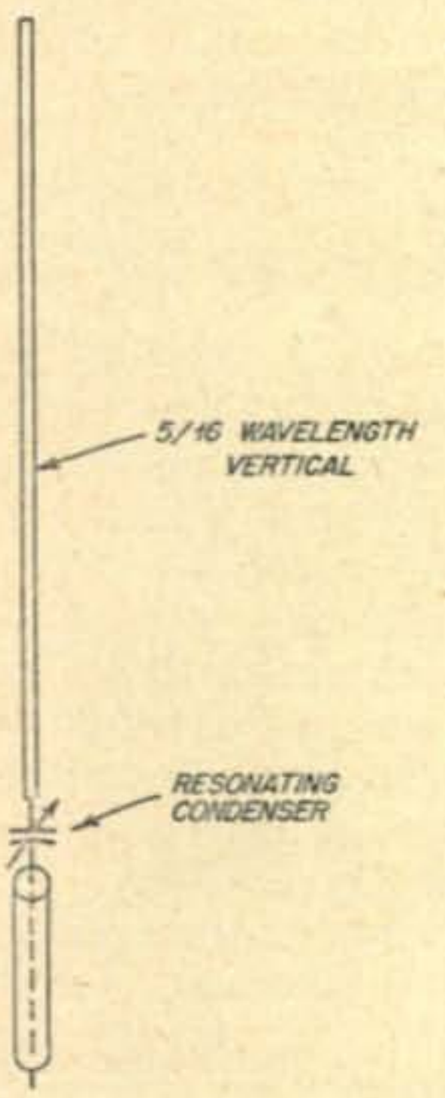

Fig 3. Connection of series resonating condenser for 5/16 wavelength radiator.

repair of

High Voltage Plate Transformers

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Chicopee Falls, Mass.

Outside of a 120 foot high, 6 element beam, crashing to earth the next worst thing that can happen in a ham shack is the failure of a high voltage, plate transformer. Since it generally is the most expensive component in an amateur transmitter, replacement is costly. Those who have contacted repair shops find that the quoted figure is usually greater than the cost of a new transformer. Possibly this is a polite way of saying that they do not want to repair the defective unit.

This leaves two avenues open to the unfortunate ham: one, he can purchase a new plate transformer, and two; repair the unit himself! Now man—don't flip! It's not as hard as you may think!

To begin with it is safe to say that most high voltage transformers fail because of insulation breakdown. The few that fail because of an "open" can be readily detected with an ohmmeter. The repair will be relatively easy if the failure is in the primary, but this is not likely. The step by step dismantling procedure of the transformer will be the same for either failure, "open" or "short". You may visualize miles and miles of wire, as fine as the hair on your head, piled high on the workshop floor in one impossible, backlash, tangle—but such need not be the case.

First the secondary wire on a high voltage transformer is large as compared to hair. Number 22 is an average size. And, second, it is quite substantial and not likely to break when winding and unwinding. The primary wire is at least number 16 and very easy to handle. The number of turns on the primary varies from approximately 100 to 300, while the secondary turns number about 2 to 4 thousand.

Likely Breakdown Points

Reiterating the statement that the majority of transformer failures is insulation breakdown, it will be found that the weakest link in the chain is where one end of the secondary winding (the innermost, first turn) is brought out and over the outermost layer of the secondary to provide two ends to connect to the terminals. The center tap is also brought out and may be a trouble spot. The entire secondary voltage is across the two ends and it is here that the insulation breakdown is most likely to occur. The entire secondary will be short-circuited *only* when the high voltage breaks down the air gap. This is instantaneous with the application of the primary circuit voltage and should blow the protective fuses. An ohmmeter test will be of little value in diagnosing this type of "short."

The next weakest link at a similar potential (the entire secondary voltage) is between the secondary winding and the paper-thin, copper, static shield between the primary and secondary windings. The shield is grounded to the frame. The normal connection is to run the shield lead into the laminations. Once again this "short" will only appear when the voltage is applied. Try removing the shield lead from the laminations, if the fuses hold, then leave the connection off permanently. It might be mentioned here that if the replacement of the shield is a problem, do not replace it. The loss of the shield is preferred to the loss of the power transformer. Conversely, a shield replacement can be made from Reynold's Wrap Aluminum if needed.

Dis-assembling the Transformer

At the start it is obvious that the absence of tar will greatly add to the ease of repair.

1. A visual inspection will tell whether the terminals or terminal board should be removed first. Ceramic terminals crack easily so use caution in removal.

2. Next, remove the bolts and case. Inspection of the internal terminal connections will reveal any open or shorts at this time. Should tar hold the case to the core, it will be necessary to remove the tar CAREFULLY with a knife and screwdriver, or other suitable tool. The tar will chip away like ice, if first you chill the transformer in the refrigerator. (About one dozen, long-stem roses will cool off the XYL.) Placing the transformer in boiling water is no easier and a lot messier.

3. Now drive out the beveled wooden or fiber wedges between the metal laminations and the winding core material using a wide, thin, flat tool. The winding core is laminated paper and at least ⅛" thick; therefore there is little possibility of damaging the secondary winding, so don't be afraid to use the hammer should the wedges at first be reluctant to move.

4. The removal of the wedges will permit the withdrawal of the interleaved, iron-laminated core material. It is best and usually necessary that the core be removed one lamination at a time from an entire side, or end, depending upon core design. The opposite laminations may then be removed as one unit and will make the re-assembly faster and easier.

5. This should now free the two basic windings—primary and secondary. At this point carefully inspect the insulation for any breakdown that may have occurred between the windings and the iron core, just removed. An insulation breakdown is generally no more than a pin hole in size, so scrutinize very carefully and *don't expect* anything larger than a pin hole!

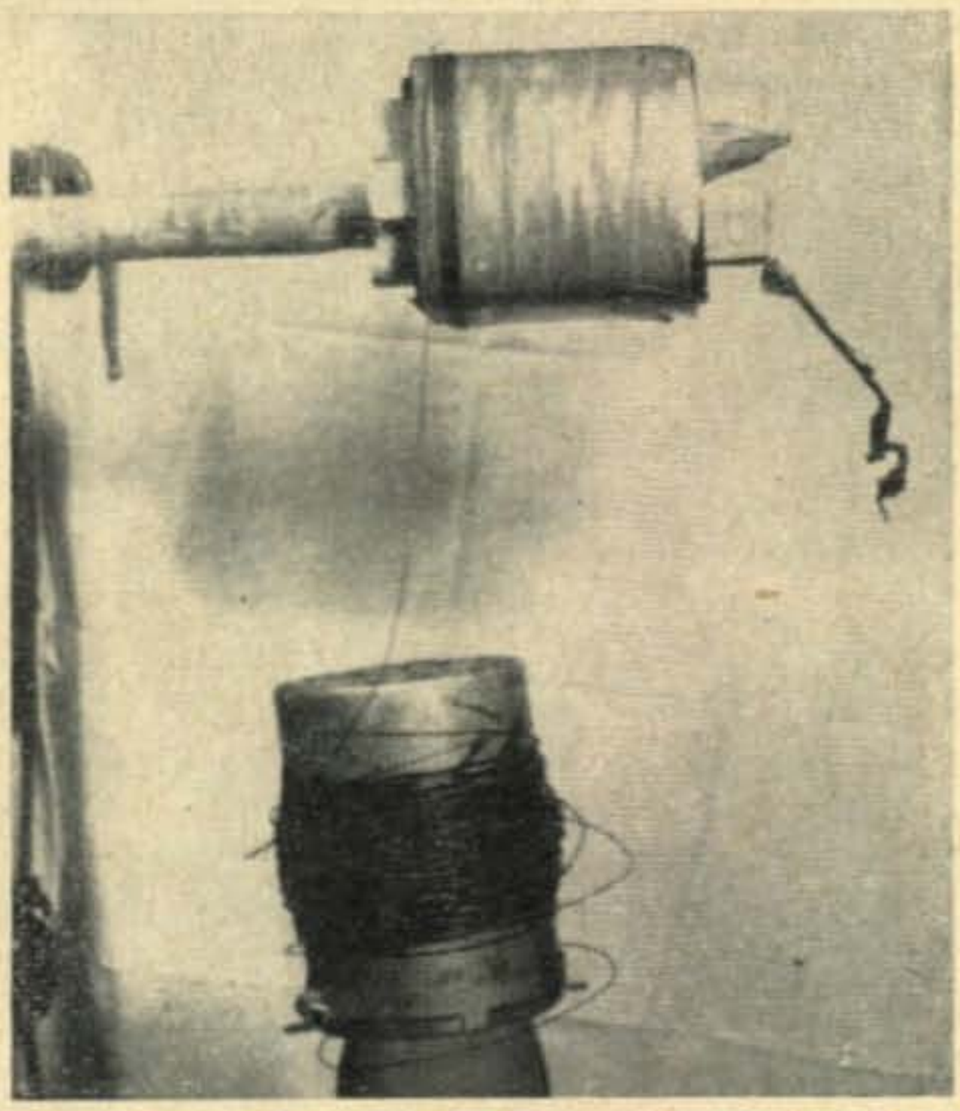
Defective Thordarson transformer, rated at 3400 volts, 700 mils, Trouble—Three outside secondary turns shorted to case.

Unwinding the Coils

1. Further inspection will tell whether the primary is the innermost or outermost winding. When the primary is outermost proceed as follows: Remove the layers of insulation, make no attempt to save any, and as each layer of insulation is removed, inspect for "shorts" or "opens" as the case may be. Look particularly at the point where the primary wire leads leave the core radius. Now remove the primary windings, counting the turns as they are removed. This is important! Write the number down so you won't forget it! Unwind the primary onto a large round object, it will make rewinding easier—and don't kink the wire.

Jig made from 1" dowel to assist in repair.

Transformer completely apart. Secondary consists of 2 identical, independent windings. Only one coil was defective.



Rewinding of one secondary coil, on jig. Note large cylindrical "take up" reel, used for wire storage.

Westinghouse transformer, rated at 4200 volts, 1.7 KVA. Trouble: innermost first secondary turn shorted to outermost layer. This transformer and the Thordarson were the only two that required partial removal of secondary wire.

2. When the primary winding is innermost, usually it is entirely independent of the secondary and removal of the friction wedges will free the primary. Inspect and set aside temporarily and turn your efforts to the secondary. Primary failure because of a short is a rarity, the most common trouble in that winding is an open terminal connection.

3. Before any insulation is removed from the secondary—inspect for a "short" at the places most likely to break down as previously mentioned. If all seems normal start removing the insulation layers, static shield, and then the remaining insulation. Again, as each layer is removed, observe closely for pin holes.

4. To assist in the unwinding and re-winding of the transformer a jig should be made with a dowel about one inch in diameter. Fasten a square or rectangular form to one end to fit snugly into the paper core of the transformer. Two U shaped brackets will hold the jig to the bench top yet permit it to rotate. The brackets should create just enough friction to hold the jig securely in any position.

5. If no breakdown is found up the first layer of secondary wire, start unwinding. As with the primary, wind it on a round object, such as a can, larger in diameter than the winding core. A "take up" reel of large diameter makes re-winding easier. Do not kink wire. The entire secondary can be unwound in this manner. Do not attempt to save any insulation.

As the layers are removed, inspect, upon discovery of a breakdown —re-insulate. It is recommended that Scotch Brand #33 electrical tape be used, rated at 10,000 volts breakdown. Varnished cambric or linseed oil impregnated linen tape may also be used, but it is thicker and may result in an overall outside diameter measurement that will not fit into the defined, iron-laminated, core area.

Re-assembly of the Secondary

As you re-insulate, use one layer of #33 tape between secondary wire layers. Three layers between the outside secondary wire and the shield; or the primary winding. Overlap the three layers of tape 50 percent, resulting in 6 layers—rated at 60,000 volts breakdown!

The secondary will re-wind easily, adjacent turns being neatly close wound, single layer. Do not scramble wind.

One word of caution—try to keep the layers tight to the previous layer as the outside diameter cannot exceed the space limitations of the iron-laminated core winding area, as mentioned before. This is why, thin, high dielectric, Scotch Brand tape is recommended, allowing some leeway for the inevitable, looser, hand winding.

If it is desired to increase the secondary voltage (Never heard of a ham that wished to decrease it) just decrease the number of turns on the primary. Up to a 25 percent increase in output voltage is permissible without undue strain on any good transformer. If only a 10 percent increase is desired, use a 10 percent figure.

Re-assembly of Primary

Re-assemble the primary, or rewind, using Scotch Brand tape between layers. Since the primary wire is heavy, about #14, tight, close winding is difficult. Just wind on the first layer as tight as possible, then wind one layer of Scotch tape.

Insert a single iron lamination in the core and see how much winding space is left. Check after each layer is wound. At the same time determine which two sides of the winding is limited by the iron core area. With a small

piece of wood and a hammer flatten these two sides. Be sure and support the core and the winding underneath when flattening. Your knee works just fine. Wind the next layer and repeat the flattening process. It may be necessary to wind one more layer than originally wound since the looser re-winding requires more space per layer resulting in less turns per layer. The use of thin, Scotch tape as an insulator will permit an additional layer. Do not worry about 5 turns not getting on, it will boost the output voltage only slightly.

Now insulate the entire winding with 3 thicknesses of tape, re-insert the iron lamination and wedges—bolt together tightly, including the case. Do not replace any tar removed.

Testing

The average ohmmeter resistance test across the primary will tell very little, for the following reason: the high voltage plate, transformer primary resistance is a fraction of an ohm —a small fraction— about one tenth! Therefore any test (with the average multitester) will indicate a short circuit, when such may not be the case. Check first for a "short" between the primary and case, secondary and case, and between primary and secondary. Next test for continuity of primary and between secondary ends and its center tap. The secondary resistance should be 50 to 500 ohms per section—each end to center tap. The exact resistance of the secondary is not too important, the important thing is that both sides should be equal in resistance measurement.

To "live" test insert a fuse, not more than 10 ampere rating in one primary lead. Connect an AC voltmeter to one half of the secondary. Close the primary circuit and test. Then, after removing the AC power, shift the voltmeter to the other half of the secondary and check, to see that both sides have equal output voltage.

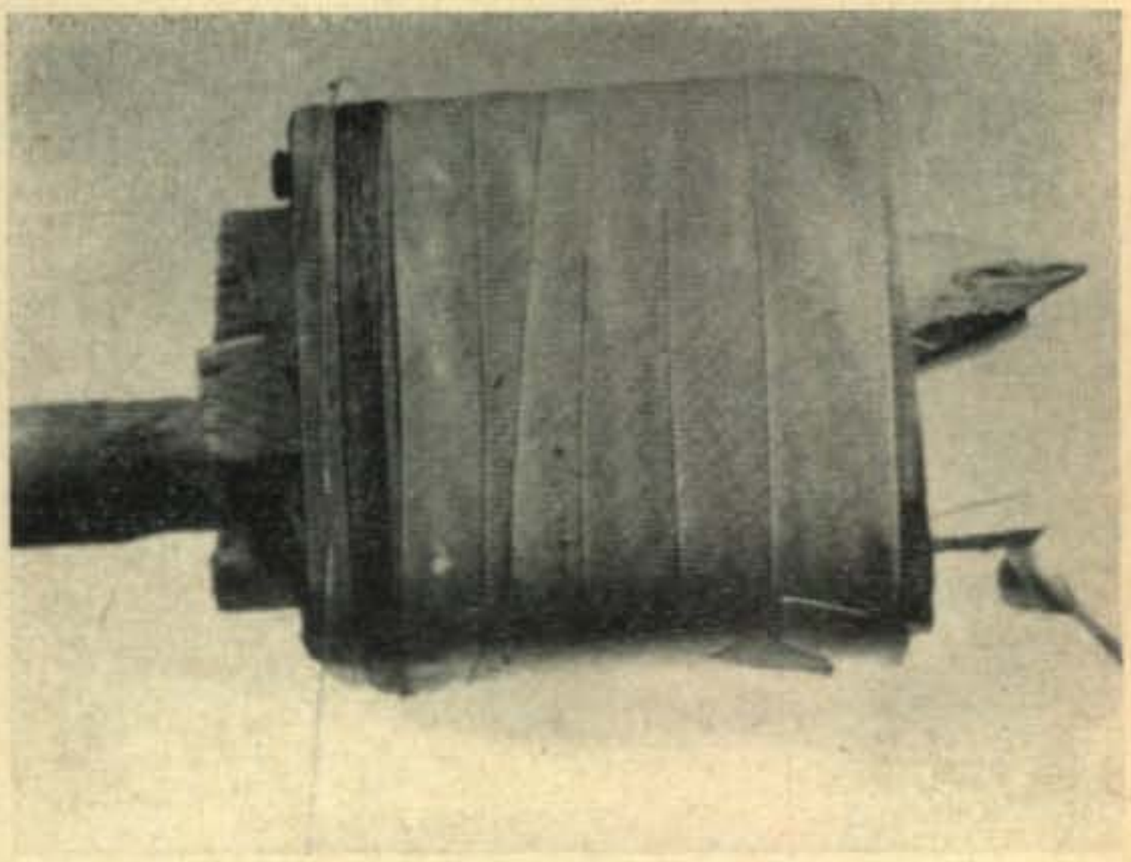
Conclusions

It is important that you use care in the secondary tests as a second chance is not likely if you take hold of the secondary winding by error. As an added precaution, always place test leads on any high voltage point with one hand. Keep the other in your pocket!

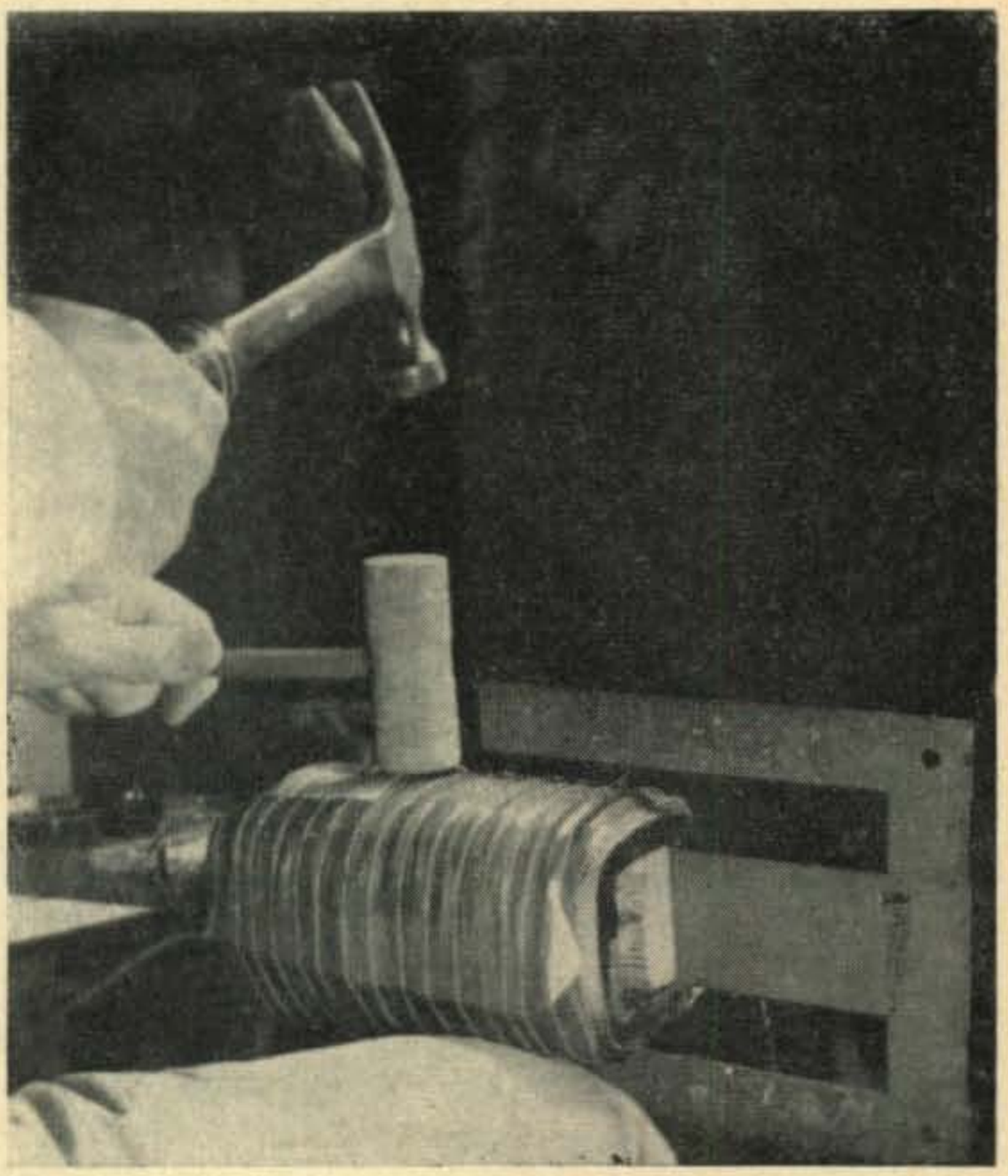
I have repaired several plate transformers and only two required partial removal of the secondary winding.

Remember the transformer is defective to begin with and you can only improve the situation since a defective transformer is headed for the junk pile anyway.

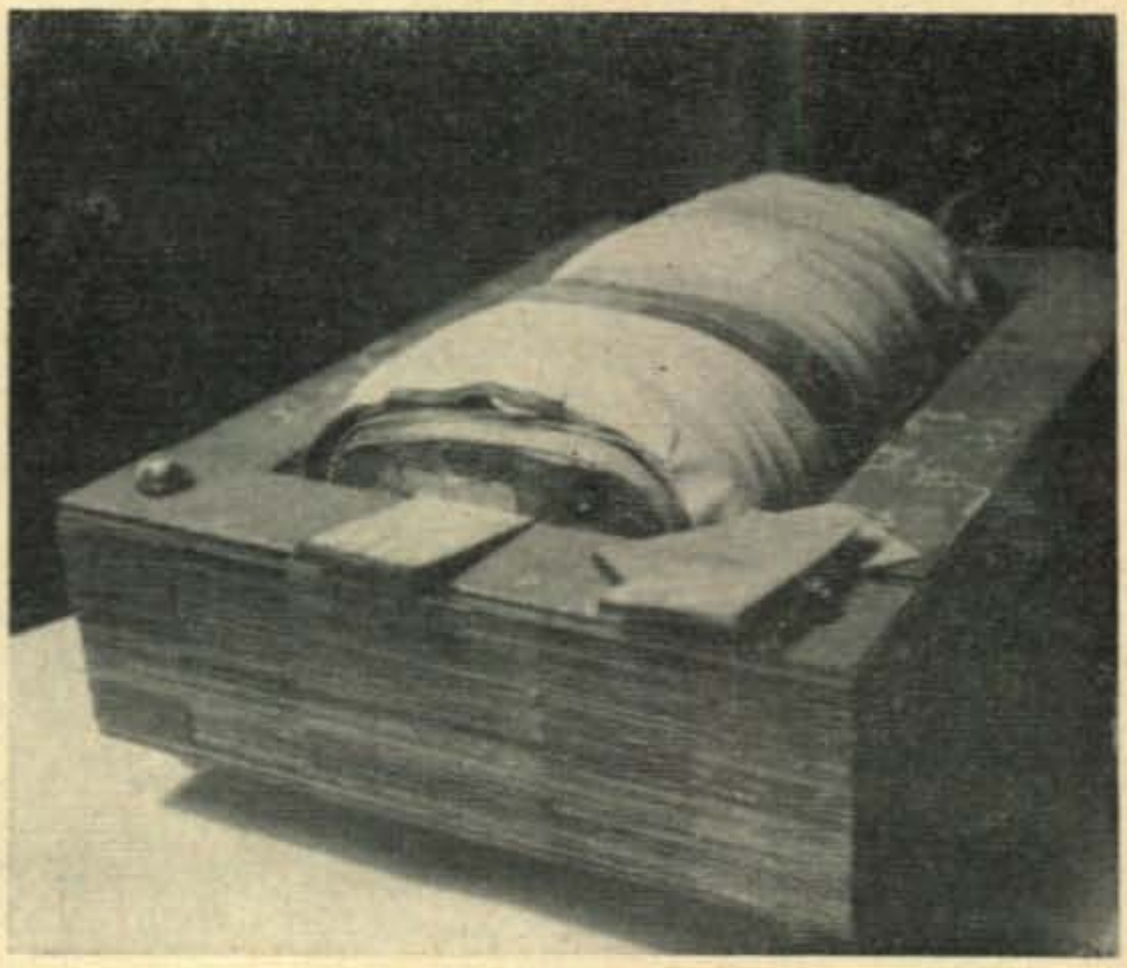
Finally should all things fail, the primary can be used for a long wire antenna while repairing the mythical damage caused by the 120 foot high, 6 element beam catastrophe at the start of the article. And a final, final—Good luck! ■



Note close wind of secondary wire.



Flattening primary winding layer. Only two sides require flattening as noted by single lamination position.



Detail of wedges used to lock iron core to coils.

All the materials needed to change the frequency of a crystal are assembled here.

How to GRIND Crystals

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St. Paul, Minn.

Quartz crystals are on the market today at very attractive prices, but unfortunately usually at frequencies outside the amateur bands. With very little expense however, it is quite possible to satisfactorily grind or etch these surplus crystals to useful frequencies. The crystals being sold today come in three general forms: plain, plated, and wire mounted. *Plain* crystals are by far the most plentiful and lend themselves best to ham uses. We are all familiar with this type . . . a rectangular or square shaped slab of quartz mounted between two metal plates which grip the crystal on the four corners by means of slightly raised surfaces called 'lands.' *Plated* crystals are mounted between similar metal plates, but are covered with a very thin film of metal, usually gold. The *wire mounted* variety are the most difficult of all to work with, and are held suspended in the holder by means of two stiff wires which are silver-soldered to diagonal corners of the crystal and electrically connected to a circular plated area deposited on the center of either face.

Practically speaking, a crystal can be ground only *higher* in frequency, since the main factor governing the frequency of oscillation is its thickness. With a little practice anyone can learn to refinish an ordinary crystal of 5 or 6 Mc up to frequencies as high as 9 Mc, with good activity and freedom from spurious responses. In addition to grinding, a crystal can be etched to the desired frequency by immersing it in a container of ammonium bifluoride. Other chemicals can be used, but this solution is practically harmless and does the job just as well as the highly dangerous acids sometimes employed. The etch bath raises the frequency of the crystal by eating away the relatively rough surface left by grinding, leaving a smooth finish which is immune to further frequency change due to aging.

Materials Needed

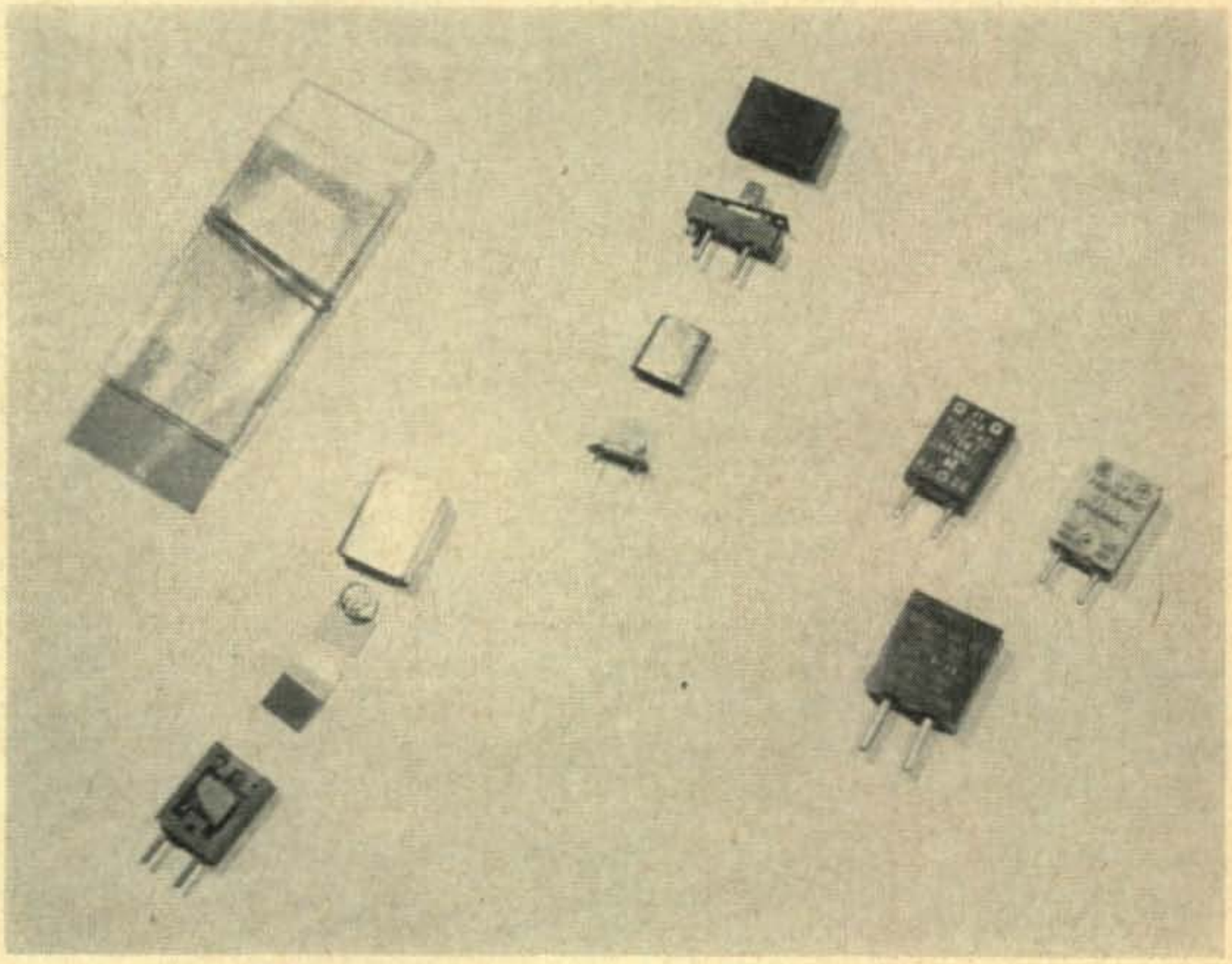
Materials:

Glass plate. (any convenient flat piece of window or plate glass.)
Supply of grinding compound.
¼ teaspoon of dishwashing detergent (Joy, . . . etc.) diluted in small glass of water.
Old toothbrush.
2 small basins of water.
Lint-free drying cloth (nylon or chamois)

The grinding compound (carborundum of silica) can be obtained from any chemical supply house or see your druggist. Toothpowder can also be used as an abrasive, but being of such fine consistency it removes ma-

terial at a much slower rate. If you are on good terms with your dentist you may be able to obtain a supply of one of the relatively coarse varieties of toothpowder he uses in cleaning teeth.

Place a small amount of abrasive on the glass plate and moisten it with a few drops of water to the consistency of a thin paste. Disassemble the crystal, being careful not to touch the inner surface of the metal holder plates. Closely examine the crystal in a good light. Notice that its opposite edges are perfectly parallel, giving it either a square or rectangular shape. Very likely the edges are somewhat bevelled or rounded off (on some units the corners are also rounded). Although difficult to confirm without a micrometer, the two major surfaces are flat and parallel except at the four corners where a slight thinning gives a somewhat pillow-shaped effect. In order to preserve this original finish on one side, place a small round mark with a hard pencil in the center of one face and do all your work on the opposite side. The mark will have to be renewed after each cleaning, but enough will remain to enable determining which side is



Shown is a hand held grinder along with two of the most common types of surplus crystals assembled and disassembled.

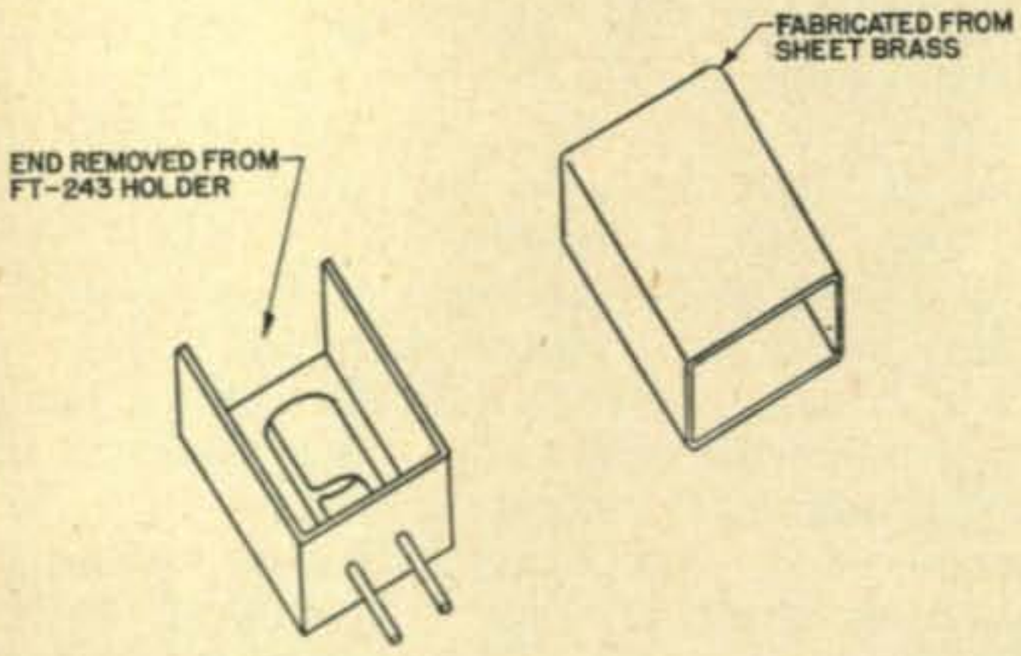
which. Since most commercially ground crystals nowadays are etched to frequency, your reference side can also be determined by its shiny surface as compared to the rough texture of the opposite side after being worked in the abrasive.

Grinding

Now for the actual grinding: Place the crystal, with pencil mark uppermost, in the compound on the glass plate. Rest the outside edge of your thumb and tip of your forefinger on diagonally opposite quarters of the surface and using moderate pressure, describe 4 or 5 figure eight movements, about one and one half inches long. Rotate the blank one quarter turn and repeat the process, making the same number of movements on each pair of corners to ensure uniform removal of material. Using the thumb and forefinger in this manner retains the desired pillow shape or slightly concave effect. It is very difficult to even estimate how much the frequency of a crystal will move by grinding. 'Moderate pressure' may be interpreted by one person as barely touching the surface, while another may take it to mean bearing down with half his weight. Somewhere between these two extremes will be found the proper course, and a little experimenting will quickly bring it out. If this is your initial attempt at crystal grinding, take it very slow and easy at first, especially if you have less than 100 kc or so to go. After each series of figure eights a check should be made for activity and frequency. Hold the blank by the edges and swish it through one of the basins of water to remove excess grinding compound. Then lightly scrub both faces with the toothbrush dipped in the soapy water. After rinsing in the second basin of water, dry the crystal with the lint free cloth. The unit should be held only by the edges during and after cleaning, and must be perfectly dry before re-inserting it in the holder. The slightest moisture will prevent it from oscillating.

If after reassembling the crystal and holder it is found to oscillate only feebly or perhaps not at all, one or more of the following reme-

This quick change holder is handy for holding the crystal for checking as the target frequency is approached.



dies can be applied. In addition to the points previously mentioned, the vigor with which a quartz plate oscillates depends on a certain ratio of width to thickness. During the grinding process as this relationship is altered, the activity varies regularly from a high value to nearly zero. Continued grinding of the flat surface will probably restore the activity. If the finished thickness happens to coincide with minimum output, one edge can be ground a little at a time to restore a more favorable ratio. Be careful however to keep opposite edges parallel and to slightly re-bevel the edge after each grinding. During processing, a poorly proportioned crystal will sometimes oscillate on two different frequencies simultaneously, separated by as much as several hundred kcs, or within audible beat range of one another. This condition can be corrected by the remedies just mentioned.

Plated and wire mounted crystals

Before working plated crystals the gold covering must be removed. It can be ground off or dissolved—in either case the frequency will be raised one or two hundred kc as a result. If desired, the gold plating and also the soldered leads on the wire mounted variety can be dissolved in a solution of the classic "aqua-regia" (royal water), a mixture of nitric acid and hydrochloric acid which can be obtained through your local druggist or pharmacist.

Although quartz crystals in the 6 or 7 mc region are only a few thousandths of an inch thick, they are surprisingly strong along their width. Thus the supporting leads of a wire mounted crystal can be removed by gripping it betweeen the thumb and forefinger and pulling the wires off with long nosed pliers, taking care to exert force only directly in line with the plane of the crystal. These units can then be finished to frequency in the usual manner and used in standard FT-243 holders if metal mounting plates of the proper size are available.

Etching to Frequency

As mentioned earlier, etching to the final frequency forestalls further changes due to aging, and also provides a means of increasing the frequency by small increments exactly to where desired. Ammonium bifluoride comes in crystal form in one pound waxed bottles and can be obtained through your druggist or any chemical supply house in the larger cities. A pound will be more than enough and should cost around a dollar. The solution attacks only glass and stone and does not harm the skin, although it bites in an open cut or abrasion and prolonged contact may cause some burning or blistering. Prepare the solution by dissolving in a plastic or waxed container 2 level tablespoons of the crystals in one cup of water. They do not dissolve very readily and warming the water will hasten the process. The crystal being etched can be immersed in the solution by means of a small basket fashioned of copper or bronze screening. The frequency will move comparatively rapidly for the first 10 minutes, gradually decreasing for the next half or three quarters of an hour. After several hours in the etch bath a crystal will assume a high, almost transparent sheen, and eventually will develop a roughened or shingled appearance, destroying further usefulness. The frequency of an average crystal which has been refinished by grinding on one side will increase perhaps 3 or 4 kc after 5 minutes of etching at room temperature, and somewhat more if the solution is heated. It is easy and practical to move a 6 or 7 mc unit 15 or 20 kc using this process. Activity is not affected since material is removed from all surfaces in equal proportion. Because the solution is soluble in water, it is only necessary to rinse the crystal in cold water and dry before inserting in the holder for testing. The ammonium bifluoride solution can be stored indefinitely in a closed, plastic container, but will eventually eat through a waxed bottle.

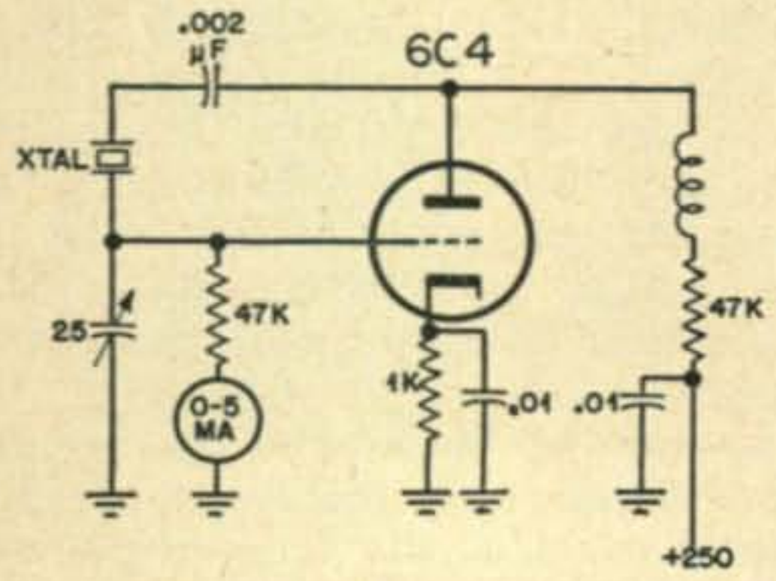


Fig. 1.

Grinding For Overtone Activity

When it is desired to multiply a crystal frequency several times in a single stage, 'overtone' oscillators are usually employed. In such circuits a small portion of energy from the plate of the tube is coupled in series with the crystal to afford regeneration, and the plate circuit is tuned to the desired *odd* harmonic. There seems to be no relationship between the vigor with which a crystal will oscillate at its

fundamental frequency and how well it will operate at an overtone mode. Good overtone activity seems to depend upon a certain thickness to area ratio and very close tolerance of all dimensions. Probably the best procedure is to bring the crystal to within 25kc or so of the appropriate frequency, carefully work on the edges and face for maximum activity and then zero in by etching. Testing for activity must of course be done in an overtone circuit, metering a grid circuit for reference. Don't forget that when a crystal is oscillating on an overtone, no output appears at the fundamental, so when spotting the frequency on a receiver it must be tuned to the proper harmonic (3rd, 5th, 7th, etc.)

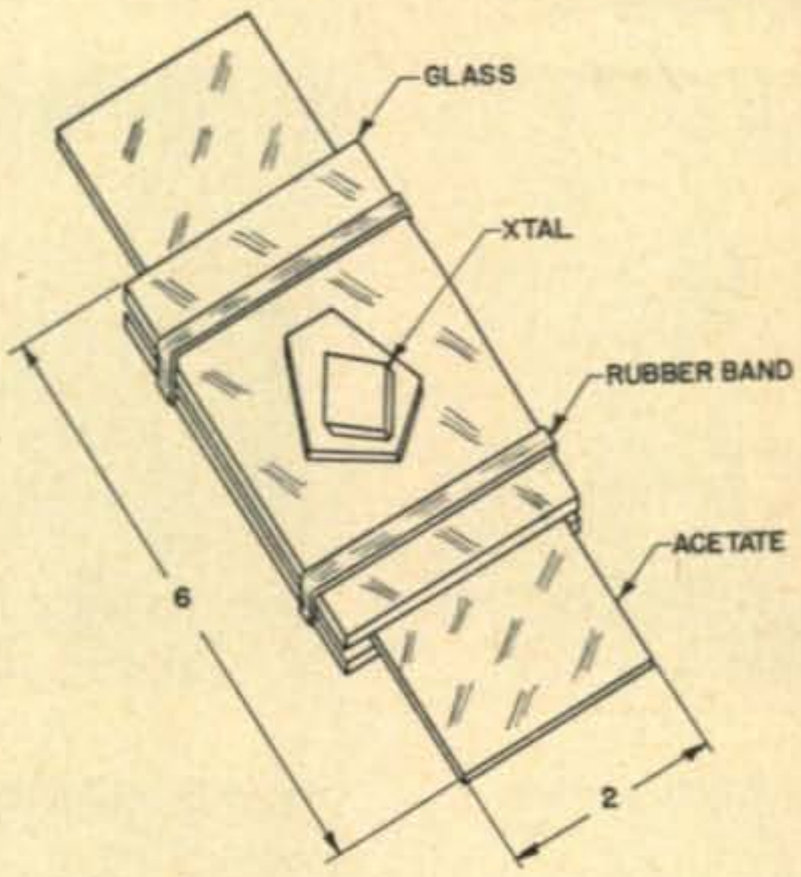
Adjusting to Frequency

Bane of the amateur grinder is the constant danger of going beyond the target frequency. Since the maximum amount the frequency of the average crystal can be lowered is about 10kc, it pays to take it easy during the final stages of grinding. The most satisfactory material for use in *lowering* the frequency is ordinary wire solder, rubbed lightly in the center of *one* face of the crystal. Use only a little at a time, since not much is required and it is difficult to remove when once applied. If only a slight adjustment is needed, a heavier spring can be substituted or the tension can be increased by using two springs together.

Since the frequency of a crystal will vary as much as 3 or 4 kc when used in different types of oscillator circuits, where it is desired to maintain very close tolerance (as in 10 or 6 meter spot nets) such crystals should receive their final adjustment in the same type of circuit in which they are intended to be used. Incidentally, while it does not seem to be generally realized, the crystal leads in an oscillator circuit are not at all critical, and can be several feet in length with no harmful effect. This feature can be very useful in a mobile rig, for instance, where the crystal socket or switch can be mounted away from the transmitter within easy reach of the operator for more convenient QSY.

Grinding Aids

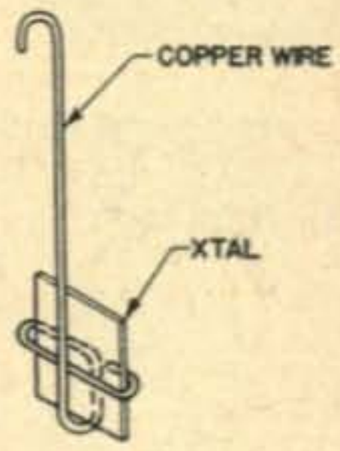
Although crystals can be ground satisfactorily with very little equipment, there are many gadgets and aids that will add pleasure to the job, especially if a large number are to be processed. *Fig. 1* shows the circuit of an activity meter using a Pierce oscillator with a small variable capacitor to control the amount of feedback. After a little experience in its operation, you will soon be able to tell if a crystal is a good active crystal. Do not overcouple the feedback however. This instrument is very simple to build and is almost indispensable for quickly determining the activity and frequency of any crystal. Also shown is a quick-change holder. Time out to build one will save much bother in assembling and taking apart the regular holders in checking. It is constructed simply by shaping a small piece of sheet brass or tin to fit snugly around the holder and soldering the seam to form a rectangular cylinder. It will slip on and off easily if the square corners of the bakelite holder are rounded off somewhat with a file. The top of the holder may be removed with a hacksaw and file, since the crystal and plates will be retained in place by the tension of the spring.



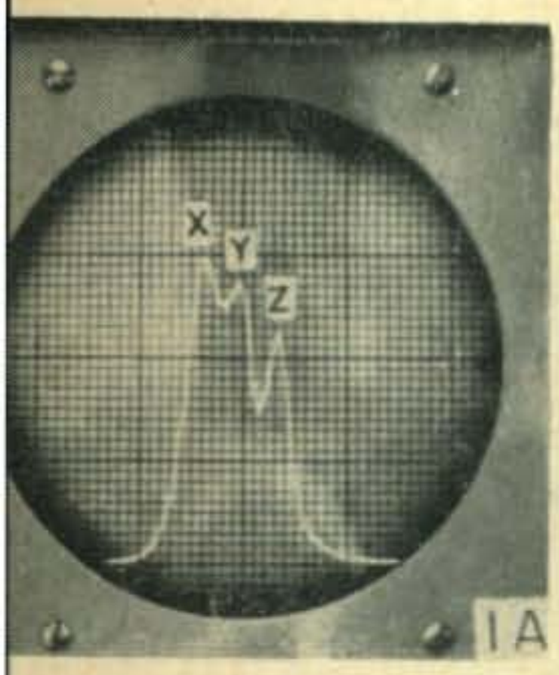
Construction details of a hand grinder.

Some workers prefer to use the hand-held grinder. This device is especially useful for grinding in rough blanks and for restoring activity to crystals whose faces have gone out of parallel.

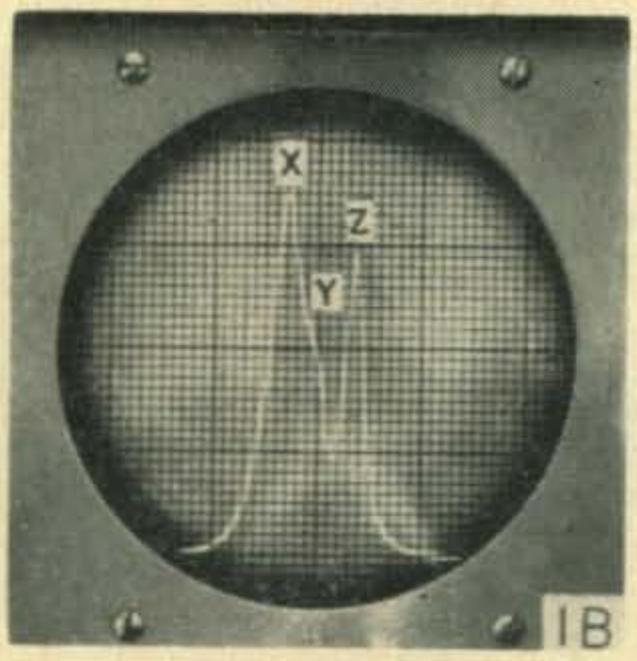
The two by four inch strip with the pentagon shaped hole in which the crystal rotates must be somewhat thinner than the crystal. Celluloid works well, or plastic sheeting can be obtained in various thicknesses at large stationery stores. In use, the plastic strip is placed on one piece of glass and the crystal, together with a small amount of abrasive and water, are placed in the pentagon opening. The second square of glass forms the top of the assembly, being held in place by means of rubber bands. Moving the strip in and out between the glass plates forces the crystal to rotate with an even, regular motion. Another useful stunt when several crystals are being etched simultaneously is to suspend them in the solution separately using wire holders bent up from #18 or #20 soft copper wire in the manner illustrated in *fig 2*. ■



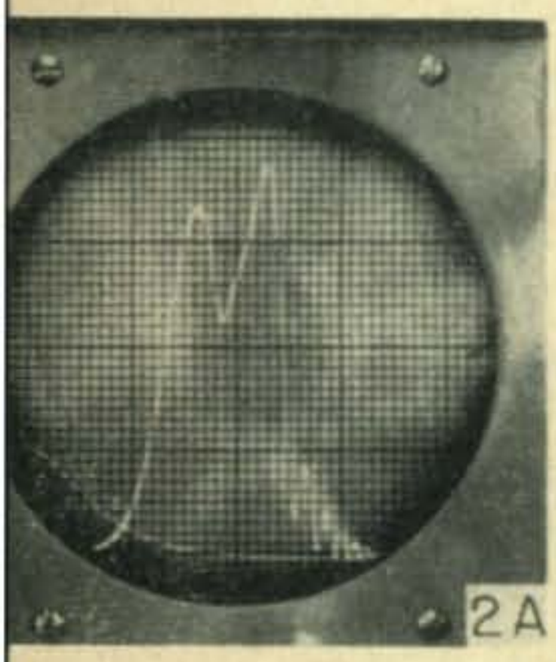
Handy for holding crystals to be etched.

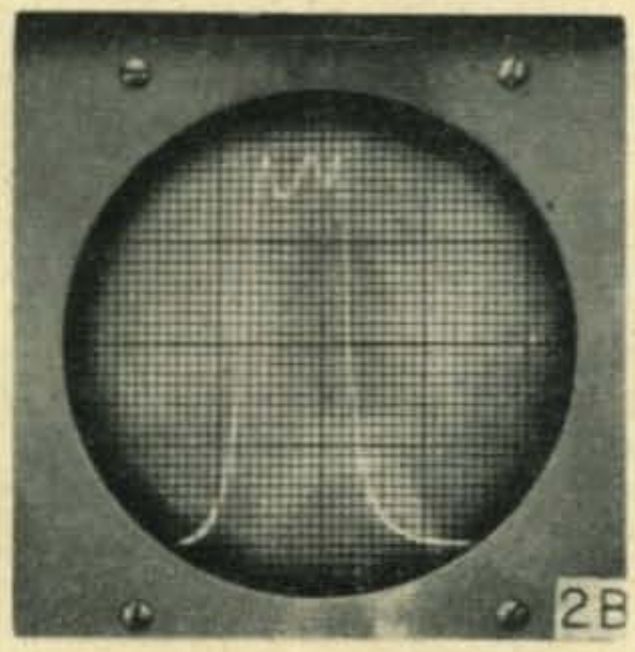


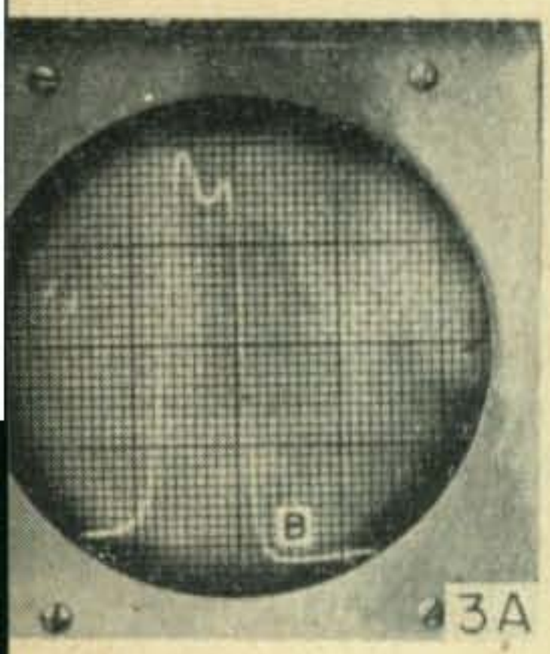
1A



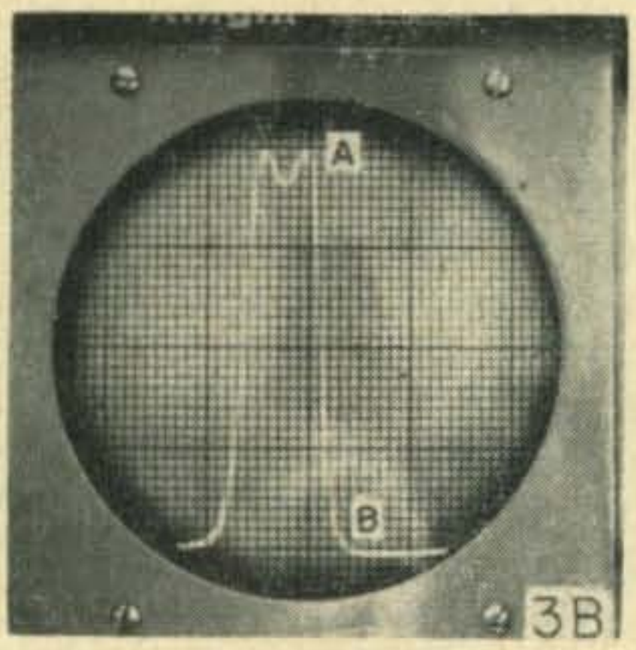
1B


2A

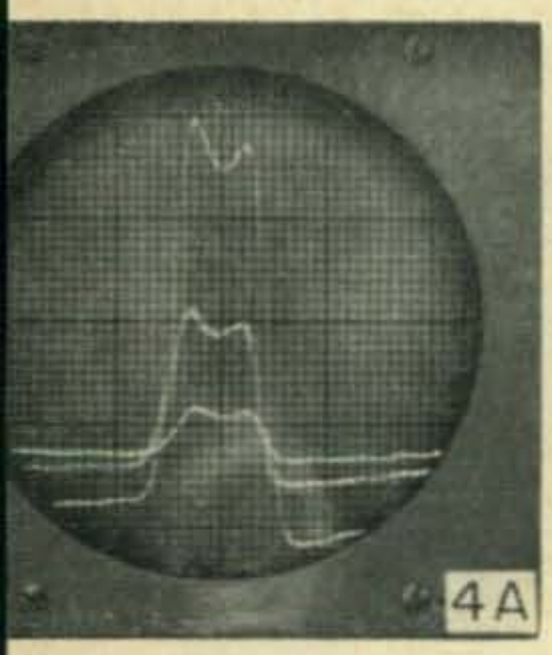

2B

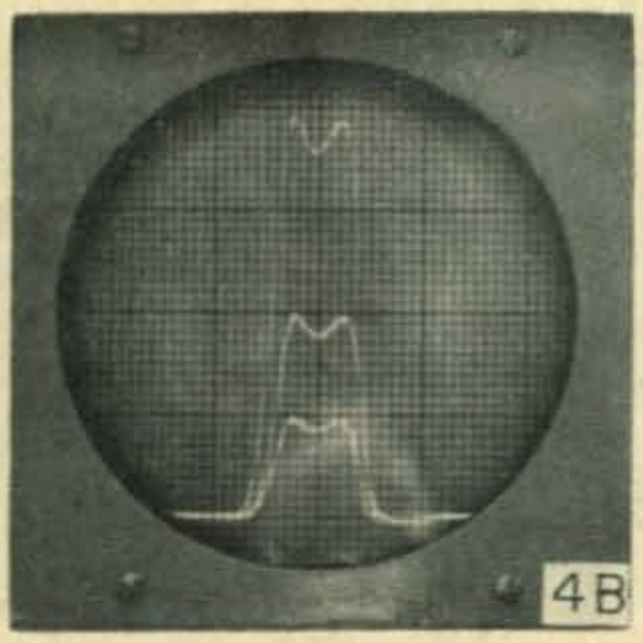


3A



3B


4A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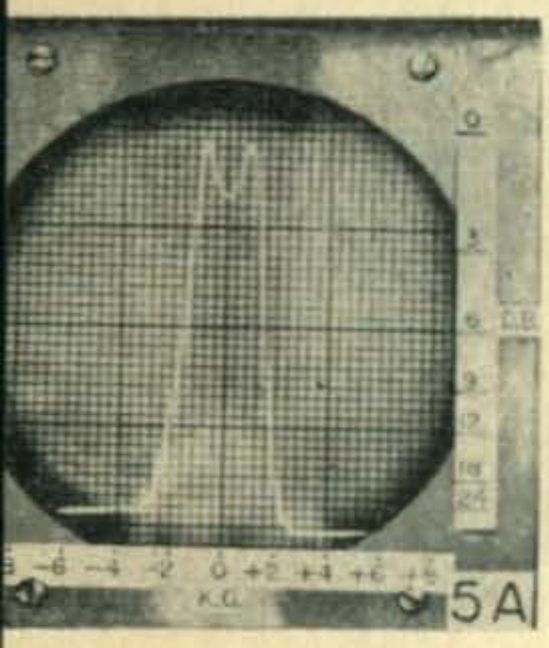
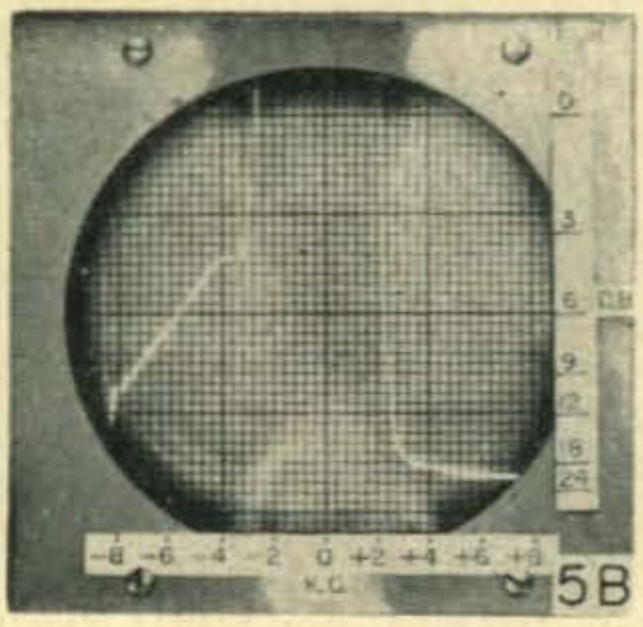


5A



5B

Filter Alignment Equipment

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Englewood, N. J.

The alignment of crystal lattice filters can be a difficult and tedious chore unless the proper equipment and methods are employed. It is the purpose to herein describe equipment and methods for making rapid and easy observations of the effects of filter adjustments, in order to encourage those who might otherwise steer clear from the use of filters either for SSB generation, or for reception, because of inadequate equipment and of the possible attendant difficulties which then become involved.

Two different alignment procedures are generally employed. One is the "point-by-point" measurement of the filter output characteristics *after* each adjustment has been made; the other is the "visual" method whereby the *whole* response characteristic is in sight *while* the adjustments are made.

With the point-by-point system, the output of an rf signal generator is fed into the filter, with the filter output being read with an rf voltmeter. The response amplitude of the filter is measured at several different frequencies within the band of operation. The results are then plotted on graph paper to provide a picture of the overall response curve. This can become a fairly long process if a complete picture is desired.

Now, if some point along the response curve is of too great, or too small, a magnitude, an adjustment of the filter must be made to correct it, but, unfortunately, when this is done, some other point in the response range also may shift in magnitude at the same time.

This is illustrated in *fig. 1A* and *1B*. *Fig. 1A* shows the response curve of a filter wherein point *Z* is low. Now look at *fig. 1B*, and note what happens to points *X* and *Y* after an adjustment has been made to bring point *Z* up to the same height at which point *X* was originally found in *fig. 1A*. This condition will not appear in every case, but it is merely shown as an example of a situation which can occur.

Thus it may be seen that a new set of point-by-point readings must be taken if an accurate overall picture of the curve is to be maintained. Needless to say, additional time and effort will be consumed, and it may become quite a repetitious and tedious job before the work is completed.

An effect which usually does not show up with point-by-point measurements is "ringing" which sometimes is heard as a hollow or pinging sound in some filter type of s-s-b transmitters. This shows up as oscillatory wave-trains such as may be seen in *fig. 2A*.

One good point, regarding this method, is that very accurate readings may be obtained once the filter has been correctly aligned.

With the visual method of filter alignment, the output of an rf sweep generator is fed into the filter. An oscilloscope, connected to the filter output through a suitable detector, is then used to enable the operator to visually note the *entire* response curve at *one* glance. Thus the effect of any *one* individual adjustment may be seen immediately, making the visual method one of rapidity with ease.

As will be found with any method of measurement, the proper equipment and techniques must be used if misleading results and inconveniences are to be avoided. Observations of good accuracy may be made rapidly when the following equipment and procedures are used with the visual method.

Sweep Generator

In order to obtain accurate results when responses having steep skirts, such as required in filters, are involved, a sweep rate of no more than 10 cps should be used, and should be lower than this when possible. Compare *fig. 2A*, where a 60 cps sweep was used, with *fig. 2B* where a 5 cps rate was used. Note the difference in the shape of the curve, and the ringing effects which appear with the 60 cps sweep.

Most of the standard sweep generators are

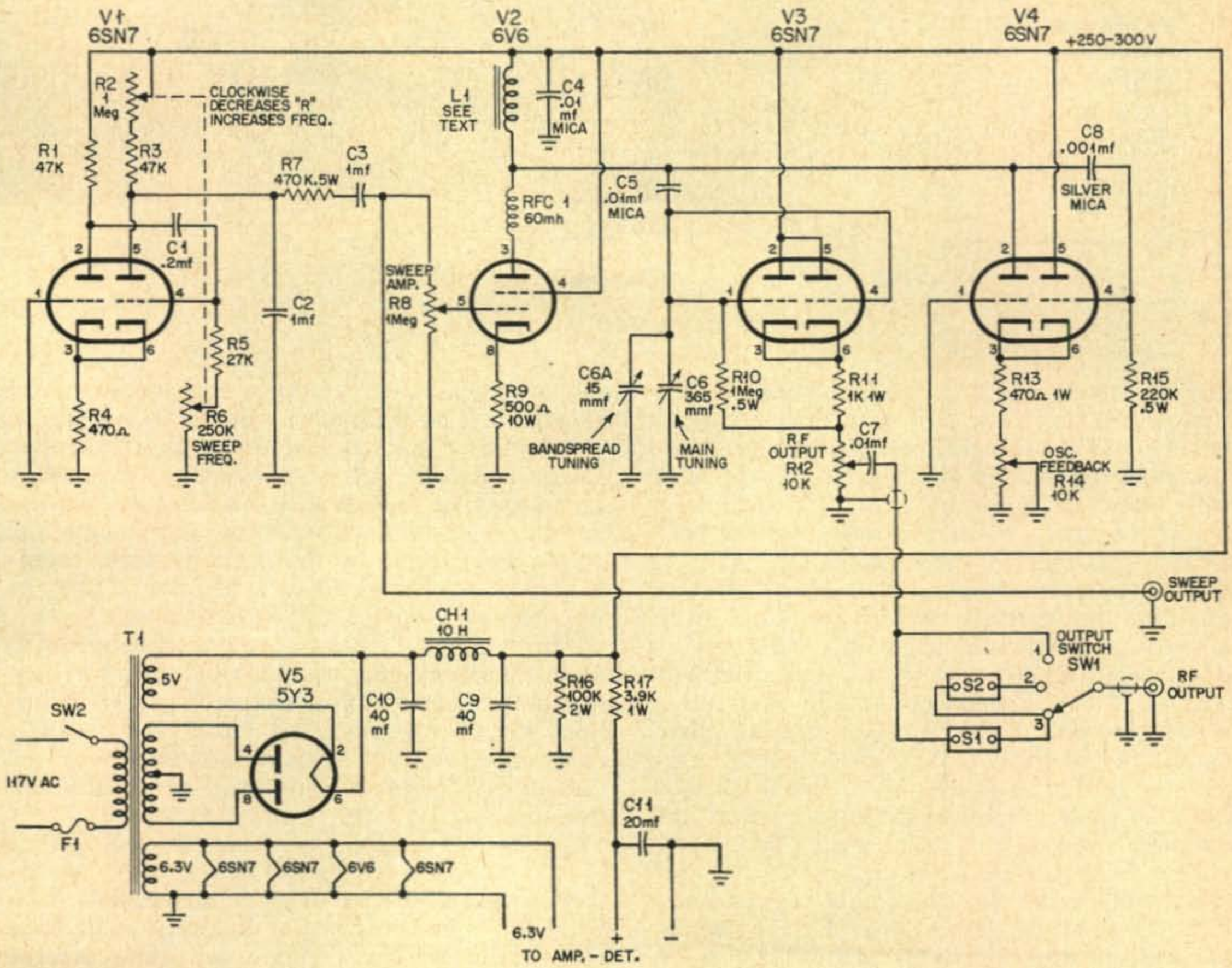

Fig. 8 Correction: the numbers 1 and 3 on SWL should be transposed.

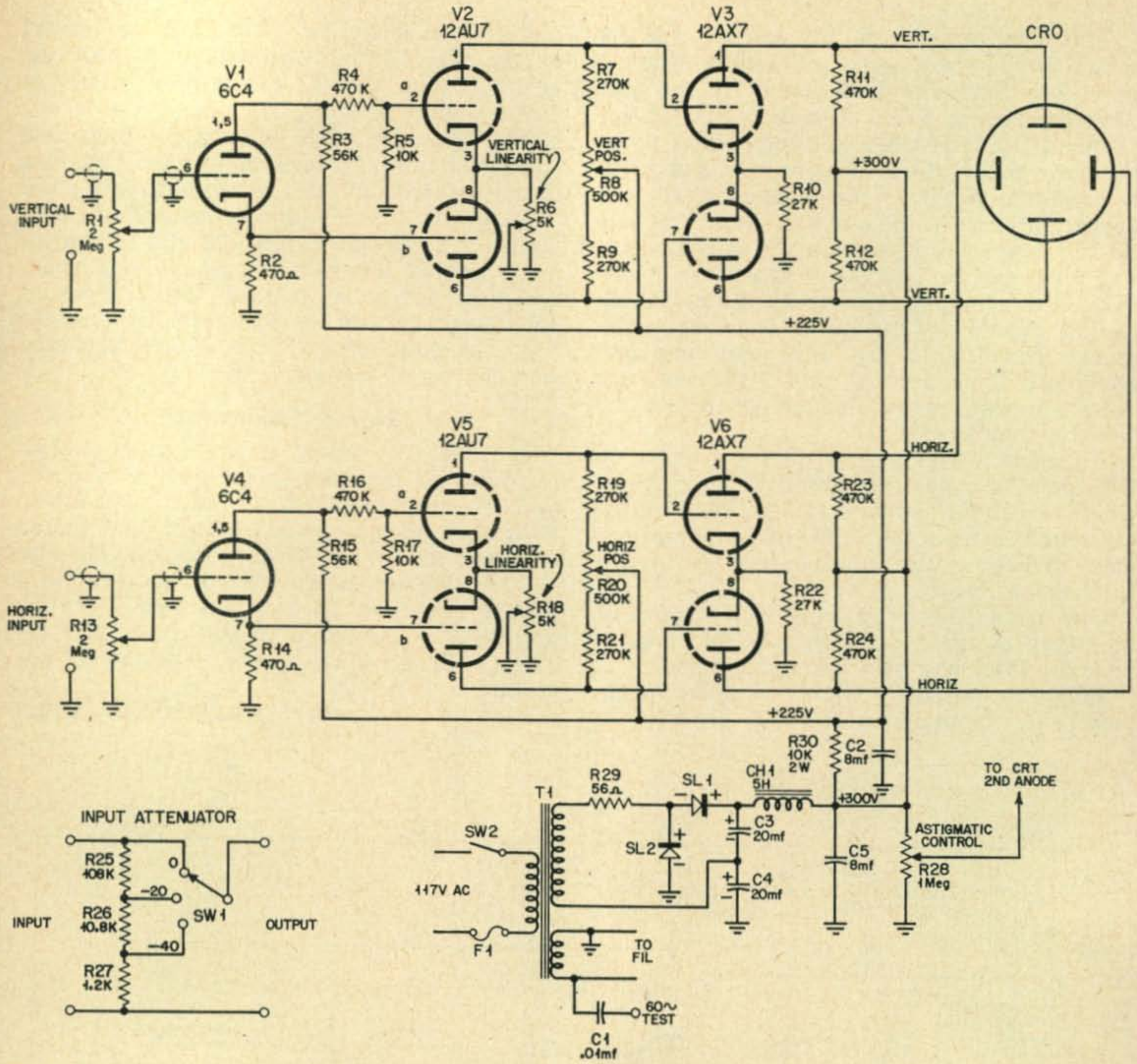

Fig. 9

therefore not suited for the job, because they utilize a 60 cycle sweep rate. Modifications could be made for a lower rate, but since the original sweep usually is taken from a 60 cycle supply source, an entirely new arrangement, including a sweep oscillator and amplifier with probable changes in the method of sweeping the rf oscillator, would be required. Rather than alter an existing sweep generator with the possibility of impairing its usefulness in the applications for which it was originally designed, a better approach to the situation is the construction of the Ferri-Sweeper, originally described in the *CQ SSB Handbook*.

A few changes from the original version should be made to improve its operation and usefulness. The circuit of the modified Ferri-Sweeper is shown in *fig. 8*.

The linearity of the low frequency sawtooth oscillator, used in the original Ferri-Sweeper, was found to be rather poor at very low sweep rates. An improved arrangement is given in the new schematic. Good sweep linearity can be obtained at frequencies down to 5 cps.

Another change made in the Ferri-Sweeper is the addition of a bandspread capacitor which may be used as a vernier. It may also be calibrated in small frequency increments for subsequent checks by the point-by-point method if it is desired to do so as explained later in the text.

The final refinement is the inclusion of a means whereby the oscilloscope may be calibrated for specific filter frequencies. This provides for the switching-in of crystals by *SW1*. This procedure will be explained later.

Also, *C4* has been included for additional rf bypassing.

Oscilloscope

Most oscilloscopes employ ac amplifiers to bring the signal level up sufficiently to be seen adequately on the cathode ray tube screen. When a very low sweep rate is used, distortion

of the pattern usually is experienced, because the ac amplifiers include one or more coupling capacitors which generally are too small for use at low sweep frequencies. *Fig. 3A* shows the pattern distortion when improper coupling capacitors are used, as compared to the correct picture as shown at *fig. 3B*. Note how points *a* and *b* drop off in *fig. 3A*.

Another difficulty which can be found with oscilloscopes using ac amplifiers during filter alignment, is that the base line often shifts as the signal amplitude is varied, and the amplitude of the ac signal may vary to a different extent on both sides of the base line. These efforts then require re-positioning with the oscilloscope controls in order to maintain a constant base line reference point every time the signal amplitude is changed, and one must then "chase the base line around." Besides this, when the centering controls are then used for re-positioning, the response is often slow to settle down, and the job is prolonged.

Fig. 4A demonstrates how the base line can shift with different signal amplitudes when an ac amplifier is used. Compare this with *fig. 4B* where a stable base line has been realized under the same amplitude variations, through the use of suitable equipment.

Although very large coupling capacitors could be substituted in the ac amplifier of an oscilloscope to minimize pattern distortion, it is suggested that an oscilloscope with dc amplifiers be used instead, because not only will a more accurate pattern be obtainable, but the spot positioning can also be made instantaneously stable, and the base line will remain fixed, regardless of the signal amplitude, to provide a constant reference point.

Some of the low-priced oscilloscope kits employ a-c amplifiers with "dc positioning." It may at first appear that these might be used with large amplifier coupling capacitors, while the dc positioning arrangement takes care of the base line situation; however, it has been found that base line annoyances are still present in many of these, because capacitors have been used which can affect the timing of the centering circuits, as well as cause the base line to shift with varying signal amplitudes.

If an existing oscilloscope exhibits any of these faults, and if one with dc amplifiers is unavailable, a simple dc amplifier arrangement can be constructed according to the schematic shown in *fig. 9*. This is admirably suited for the job at hand, and it can be connected to an existing oscilloscope; provided, all four of the c-r-t deflection plates are available for individual connections. Besides making it possible to obtain distortionless patterns, stable instantaneous positioning and a constant base line reference, it is capable of a very high output amplitude to make it possible to read to better than –60 db down from maximum peak amplitude when a 5″ cathode ray tube is used. The amplifier sensitivity is 50 mv/inch.

Two dc amplifiers are shown, one for vertical, and one for horizontal deflection. Only one of the amplifiers (vertical) may be used, if desired for the sake of economy, with the original oscilloscope amplifier used for the sweep, but the use of the *two* dc amplifiers will provide more positive positioning for both vertical and horizontal axis, and better overall spot focusing also will be realized.

In some instances, the employment of the dc amplifiers may shift the static potential at the c-r-t deflection plates to a point where the focus control cannot be adjusted for a sharp image. Some oscilloscopes may have an *astigmatic*, or *spot shape*, control which can be used to correct this. If such a control is not available, *R28* should be installed for astigmatic correction.

Since the amplifier is a linear device, the response on the c-r-t screen likewise will be linear with respect to a *voltage* ratio, but it will be non-linear as far as a *db* ratio is concerned, and the db range will be compressed into a very small space as the ratio is increased. With a 5″ cathode ray tube, the maximum attenuation at the filter skirts, which normally can be read under this condition, is in the order of –25 db down, not nearly enough for satisfactory filter measurements.

[*Continued on page 164*]

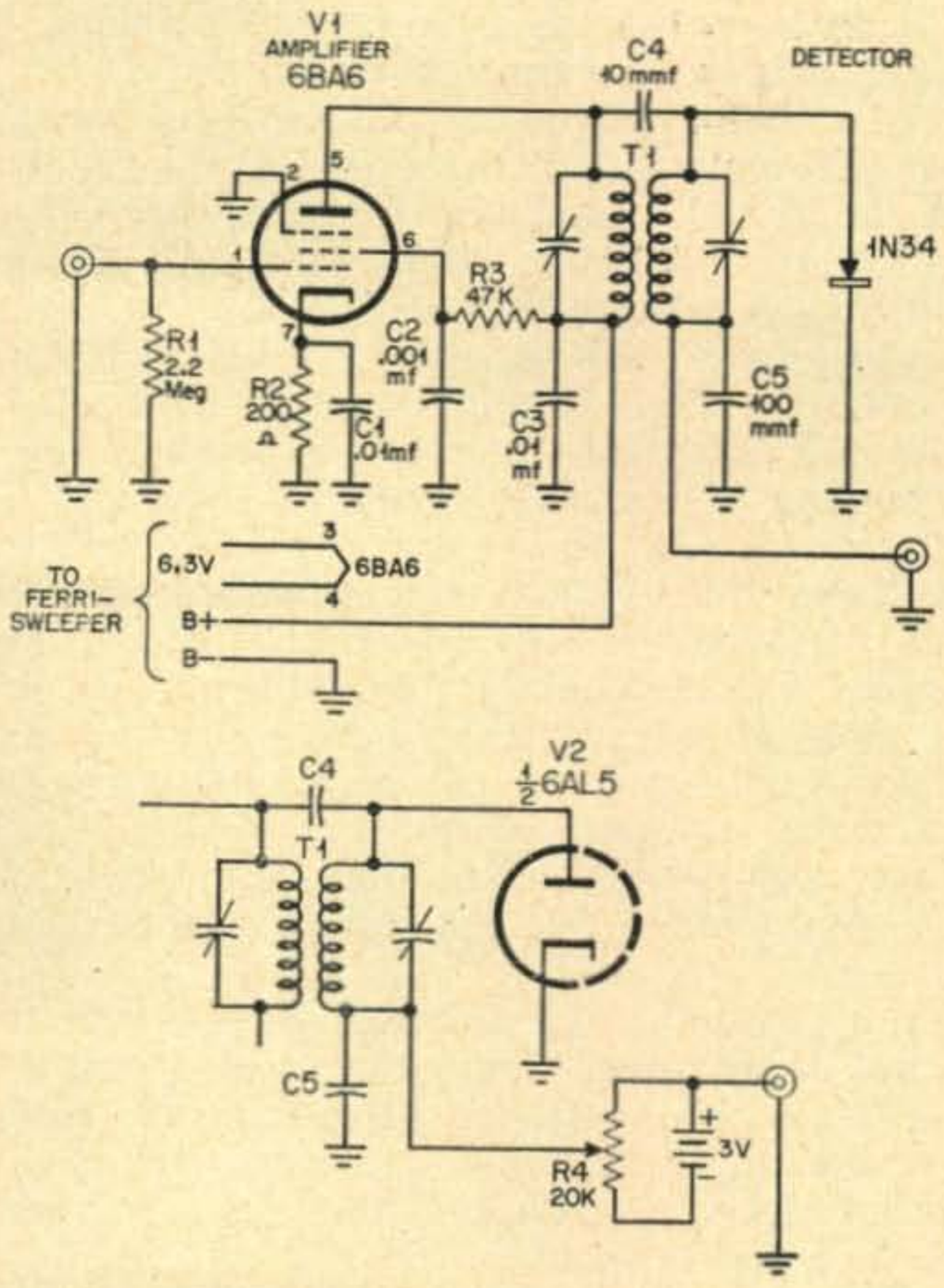

Fig. 10B

Garbage Disposal on 220

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9701 Shore Rd.
Brooklyn 9, N. Y.

With shining eyes, the happy newcomer to 220 mc unpacks his sparkling new Super XYZ-13 converter, plugs it in, and expectantly listens for signals to come rolling in. Hah!! They certainly do. Channels 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13 come rolling in twice as loud as they ever came in on the TV set in the next room. It seems that everything except amateur 220 mc signals are coming through the converter.

With heavy heart and drooping shoulders, our hero gives up and goes back to 160 meters.

This sad tale is not fiction. How many of you have tried out 220 mc converters with the same results?

Here at my shack, many long hours have been spent trying to find out why this garbage gets through the converter, and how to minimize it or eliminate it completely. The most important step is the selection of the proper i.f. range to feed into the communications receiver. If your receiver tunes as high as 30 mc with reasonable bandspread, place your i.f. range there. A good rule of thumb to follow is to keep the i.f. as high as possible.

Now that your range is picked, the converter oscillator frequency can be determined.

Say for instance, that a range of 14-19 mc is to be tuned. Oscillator injection normally would be placed 14 mc below the band, giving us an injection frequency of 206 mc.

Getting up to this frequency would call for the use of a high frequency overtone crystal in one half of a dual triode circuit at 68.66 mc, and tripling in the other triode to 206 mc.

This being common practice, it is to be expected that this system would work well. It would, if there were no TV stations active on Channels 6 and 9, and no 6 meter activity in your area. If any of these signals are on the air, you can expect to get plenty of garbage from these sources.

How? Let us now delve into the matter of *image frequencies*. See the light? If not, read on.

Let us examine the injection frequency of 206 mc. The image frequency comes out at 187-192 mc, or 14-19 mc below the injection frequency. In more practical terms, this puts our i.f. range right smack in the middle of the video and audio signals of Channel 9 (fig. 1), thus covering up the 220 mc band almost completely.

TV Channel	Channel Freq. Mc	*Video Carrier*	*Audio Carrier*
2	54-60	55.25	59.75
3	60-66	61.25	62.75
4	66-72	67.25	71.75
5	76-82	77.25	81.75
6	82-88	83.25	87.75
7	174-180	175.25	179.75
8	180-186	181.25	185.75
9	186-192	187.25	191.75
10	192-198	193.25	197.75
11	198-204	199.25	203.75
12	204-210	205.25	209.75
13	210-216	211.25	215.75

Fig. 1 TV Channels and Carrier Frequencies

Are you discouraged yet? Stay with me a little longer, as things will go from bad to worse (if possible).

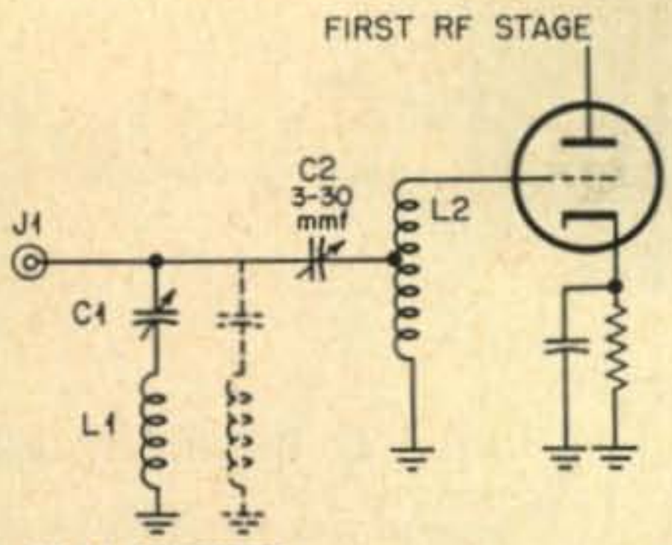
Moving on to the crystal frequency of 68.66 mc, we find that the beat on the high side is Channel 6, and on the low side is Channel 2 and the 6 meter amateur band. Inasmuch as some 68.66 mc energy is present in the output of the tripler stage, it too will beat with its respective TV channels and ham band to add to the bedlam already being created by Channel 9.

This comparison of image frequencies applies to any i.f. range that is chosen. As you can readily see, picking out an i.f. range is not a simple job if you want to have a garbage free converter.

There *are* steps that can be taken to eliminate junk of this sort. The only kind of garbage that cannot be eliminated is the type of junk that comes from the local oscillators of TV sets, and their associated harmonics that fall directly into the 220-225 mc range.

The first step to take to eliminate this junk is to place the local oscillator on the high side of the band, therefore, for an i.f. of 14-18 mc the injection frequency would be 239 mc, and the receiver tuned from 19 to 14 mc. 220 mc would then fall at 19 mc, and 225 mc come out at 14 mc. That's right! You tune from the high end down, in order to cover the band. This step puts the image frequency at 258 mc where there is a beautiful lack of commercial activity in most areas. That leaves us with only the crystal frequency of 79.66 mc to contend with.

The resultant beat frequencies fall into Channel 3 on the low side, and the FM band on the high side. Either of these, if troublesome, can be eliminated by trapping them out at the front end of the converter without affecting performance (fig. 2).



J1- CO-AX CONNECTOR
C1, L1- TO RESONATE AT THE INTERFERING FREQUENCY- MORE THAN ONE TRAP CAN BE USED IN CIRCUIT TO ELIMINATE INTERFERENCE FROM DIFFERENT TV CHANNELS.
C2- 3-30mmf TRIMMER- TUNE FOR BEST SIGNAL TO NOISE RATIO.
L2- NORMAL GRID INPUT

Fig. 2

The same thing can be done to trap out interference from Channels 7 through 10. For the rest of the high channels, these traps, because of insufficient Q, also have somewhat of an attenuating effect on 220 mc signals. The only thing that will work on the high channels (as well as the rest of the spectrum) is a high Q circuit at the input of the converter.

It is not necessary to modify your converter to do this. Just add the circuit externally and it will do the job as well.

The coaxial circuit as shown in fig. 3 is the outgrowth of many feet of copper tubing of all sizes and shapes, not to mention burned and cut hands, fingers, and frayed nerves. Ah me. What we won't go through for the sake of ham radio. Getting back to the subject, this GDU (Garbage Disposal Unit) will do the job where all other methods have failed.

It merely consists of two lengths of copper tubing, a small condenser, and a couple of coax connectors.

The frequency response is so sharp that it has to be returned when moving 500 *kc* across the band!

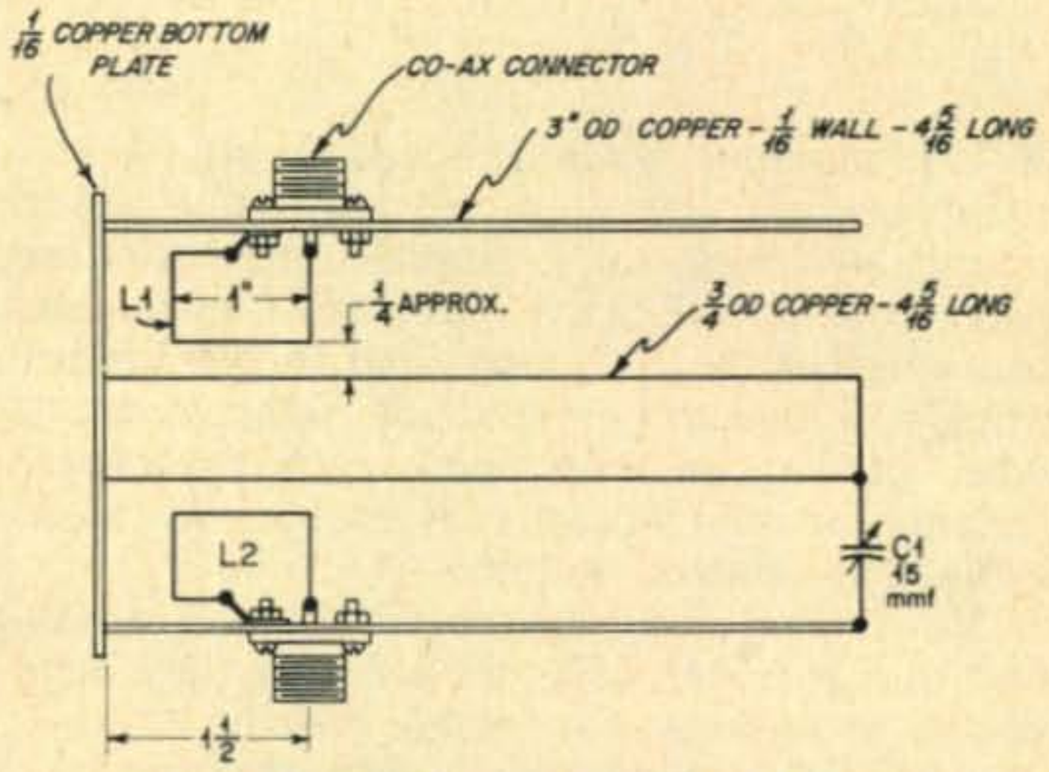
Attenuation of signals at the tuned frequency is negligible, being in the order of one db. An impressive feature is that it improves the signal to noise ratio of the converter considerably. This development has been observed by others using the same type of coaxial circuit both at 144 and 220 mc. This bears out the fact that the sharper the bandpass of a receiver at any frequency, the higher the signal to noise ratio will be.

The only adjustment necessary to obtain optimum performance aside from tuning to resonance, is to properly position the coupling loops with respect to the center conductor, by bending them closer or further away. On my unit it came to about ¼" for each loop.

Construction of the unit is not difficult. The outer conductor is made of 3" OD copper tubing with a 1/16" wall, so that the ID is 2⅞". The inner conductor is ¾" OD of any wall thickness. This material can be obtained at any plumbing supply house.

First drill the holes for the coax connectors in the outer conductor, and file a semicircular notch in the end of the conductor for mounting the tuning condenser.

The easiest way to solder the inner and outer conductors to the 1/16" thick copper bottom plate is to first scribe circles on the bottom plate denoting the mounting positions of the conductors, and placing the plate on a stove or hot plate.



C1- MIDGET 15mmf VARIABLE (HAMMARLUND MAC-15 OR JOHNSON 15M11)
L1-L2- #16 TINNED WIRE (SEE FIG. 4 FOR MOUNTING DETAILS)

Fig. 3

Place the conductors in the proper position, turn on the heat, and flow solder into the joints. The copper will start to turn color when the proper soldering temperature is reached. Let the whole works cool and the job is done.

Now that the unit is bottled up, how the heck do we get the coupling loops soldered into place? Simple, when you know how. This is done by soldering the cold end of each loop to a soldering lug, to which is also soldered one of the mounting nuts for the coax connector (fig. 4).

[*Continued on page 170*]

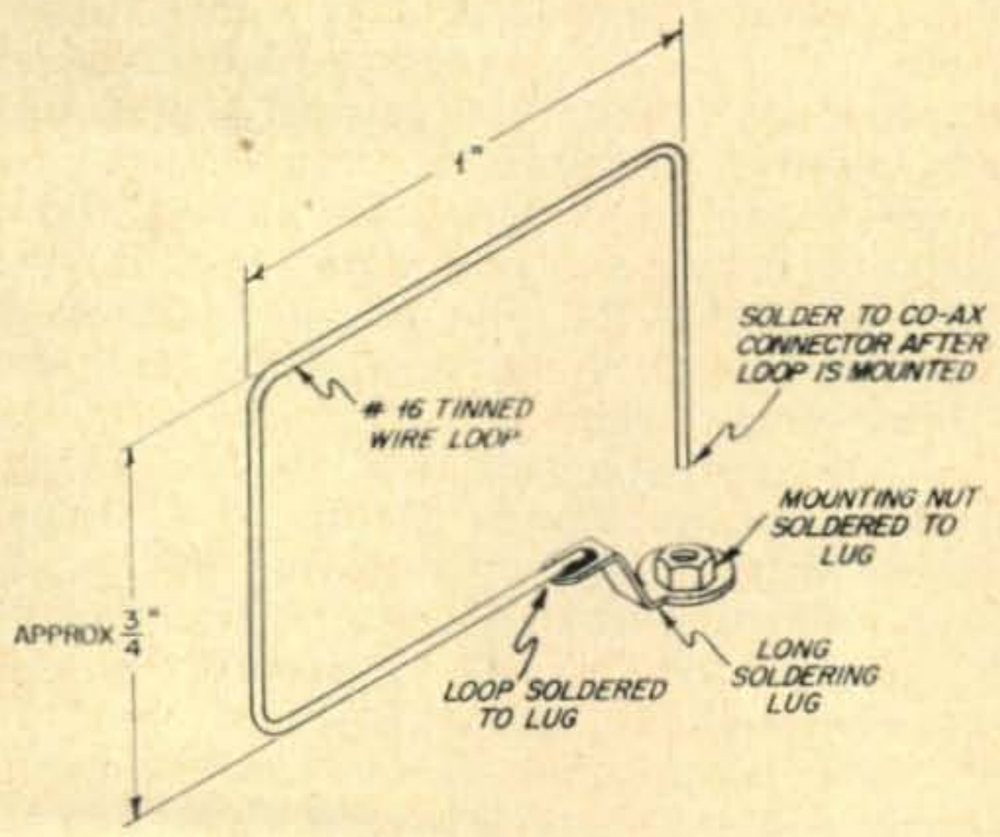
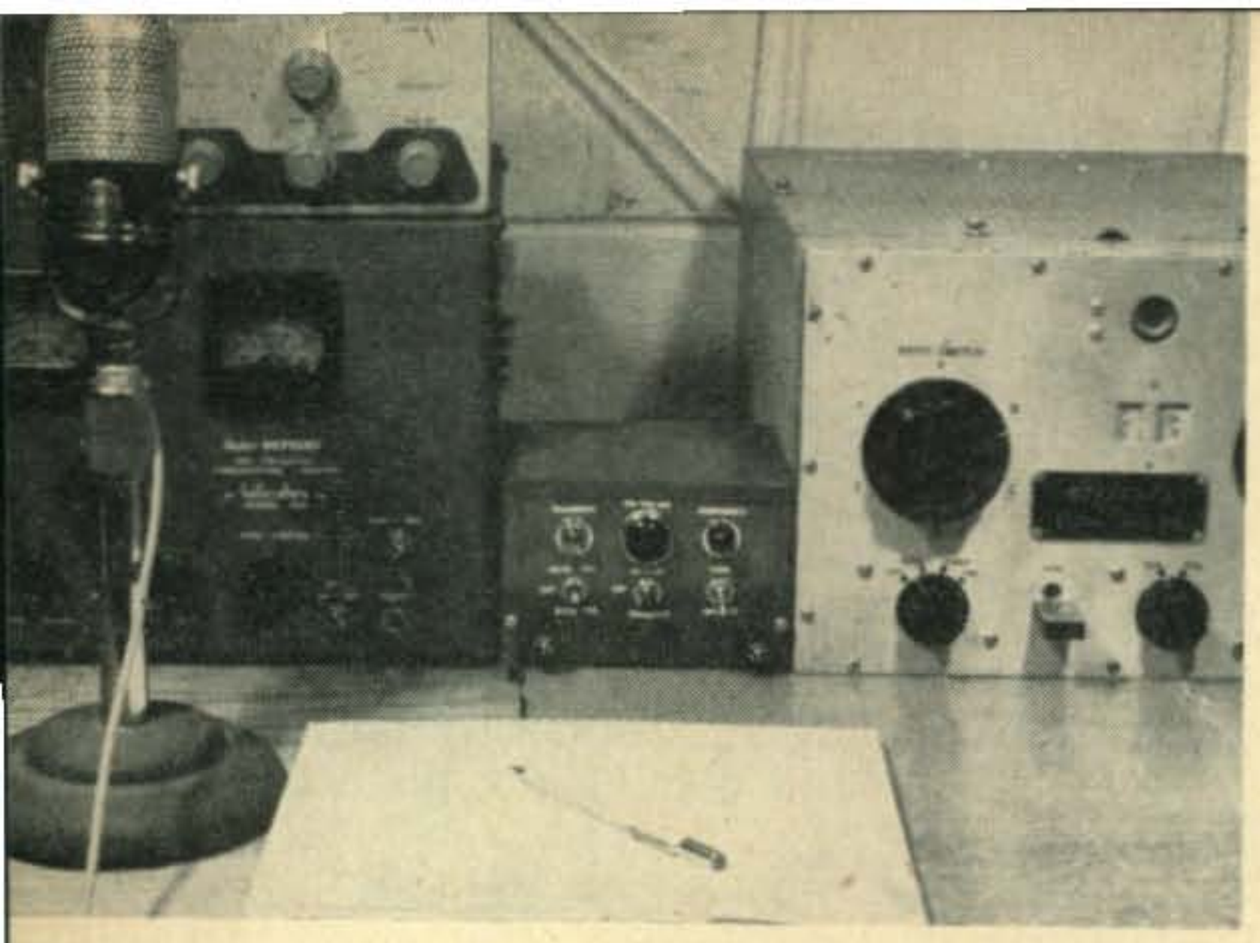


Fig. 4



Control Systems

Allie C. Peed, Jr., K2DHA
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Rochester 20, N.Y.

Every amateur station needs a convenient control center. Running all over the shack flipping switches may impress the visiting layman; but it will leave your fellow amateur cold, whether he is observing in person or waiting on the other end of your contact. If you have more than one switch to actuate to change from transmit to receive, read on, you need a control system.

If you operate a commercially built transmitter and receiver, chances are that they have internal provisions for single-switch control. At most, with equipment of this sort you will need only a DPDT relay and a switch to control both units. (See *diagram next page*)

A glance at this circuit will lead to the obvious conclusion that this same thing also could be accomplished with a simple DPDT switch if actuation of the antenna relay is not a consideration (in which case a 3PDT switch will be required). In this you would be quite right, *but,* it involves extending the switch leads from both the receiver and transmitter to the operating switch on the desk. In the case of the receiver this is no great disadvantage, but with the transmitter, the lead may have a fairly high voltage on it. Even the traditional B minus lead, under "open-switch" condition, is effectively at B plus potential. For safety sake it is therefore better not to bring this lead out of the transmitter housing.

Some operators even shy away from 110-volt AC control circuits in a desk switch although with good components and proper installation it is quite safe. However, if desired, the control circuit can be designed for the relatively harmless 6.3 volt a.c. operation. In this case 6.3 volt a.c. relays must be used and a filament transformer supplies the control power from the 110-volt a.c. line.

Another approach to this is the use of inexpensive surplus 12- or 24-volt DC relays together with an appropriate low-voltage dc control voltage obtained from a transformer and selenium rectifier. (A condenser-resistor, or condenser-choke, filter is often used to smooth out the pulsating control current resulting from half-wave rectification if the relays hum objectionably.)

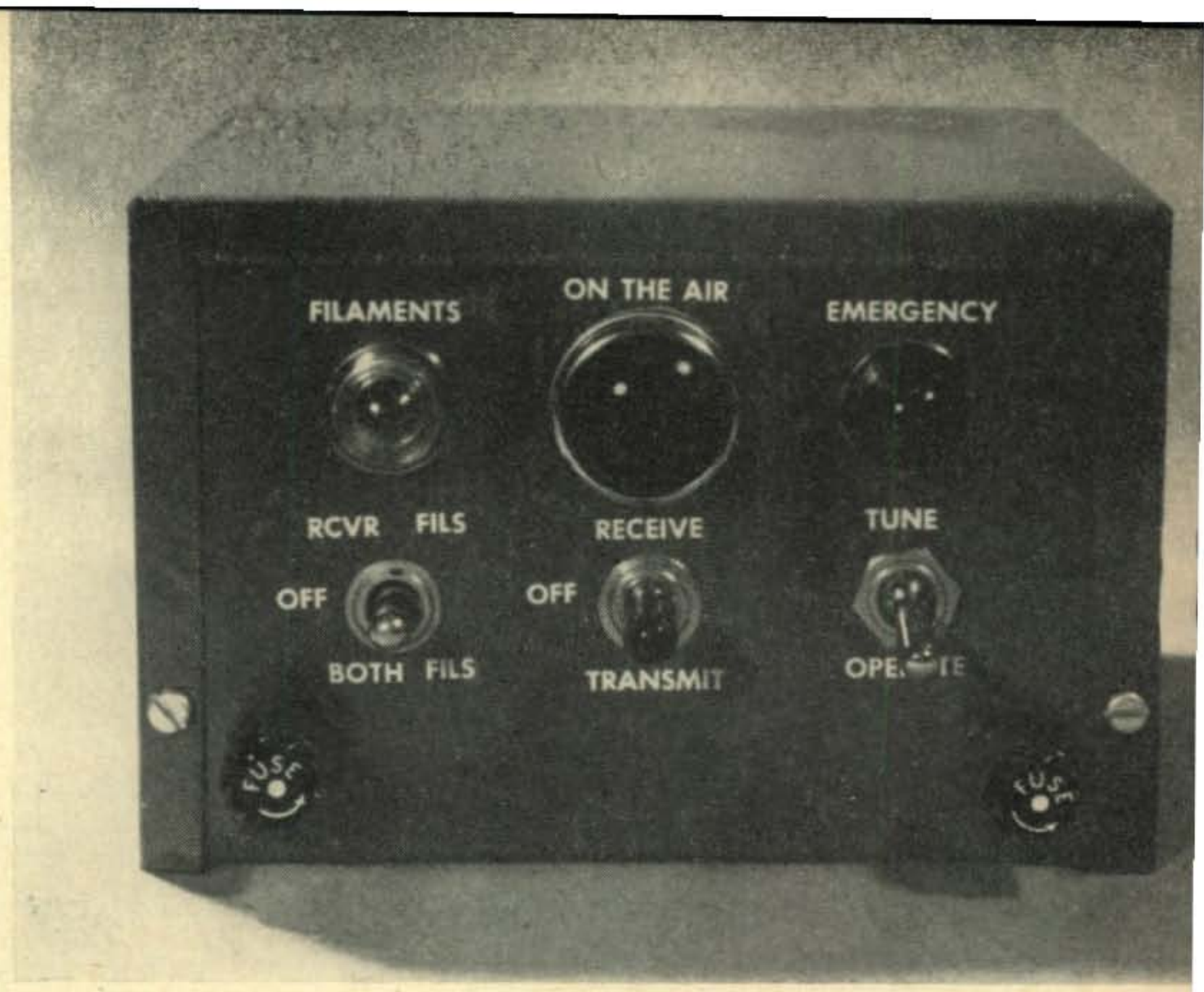
The custom-built rig is traditionally composed of a number of stages, usually on several individual chassis, and often with separate power supplies. Turning these on separately can be quite a project, not to mention the possibility of damage that can result from turning them on in the wrong order. For example, turning on the high-level modulator when the final amplifier is off leaves the modulator without a load and can lead to destruction of the modulation transformer. Or, turning a self-biased final r.f. amplifier on before its excitation is available can ruin the amplifier tube. Or, turning the plate voltage on before the heaters in any stage can lead to the early demise of the tubes.

A typical custom rig is composed of a VFO, possibly an r.f. buffer/doubler stage(s), and a final r.f. amplifier for CW operation. For plate modulated 'phone service, a speech amplifier and a high-level modulator are added to the system. These all must be turned on and off simultaneously, or in a very definite order, and yet it is desirable to have this operation consume a minimum of time to facilitate smooth operation.

The approach to designing a control system in this case was to list first those functions and features which were desired from the system:

1 - Minimum number of controls
2 - Single switch change-over from receive to transmit and vice versa
3 - Prevent application of plate voltage before filaments are on
4 - Prevent receiver from being on when when full transmitter is on
5 - Provide a "Tune" setting which turns on only the receiver and VFO for the purpose of zero beating a received signal
6 - Turn on all plate voltages simultaneously to prevent no-load damage
7 - Provide pilot light indication of the switching functions
8 - Be small enough to be built into a convenient control box at the operating position
9 - Use readily available standard components of greatest economy consistent with dependable operation.

The complete control system



10 - Provide a Conelrad Alert warning signal

With these criteria fully outlined, a rough circuit diagram was started. Borrowing the method used for diagramming industrial electronic controls greatly facilitates the design of such circuits. This is done by drawing two vertical parallel lines — one down each side of the page. These represent the current supply (110-volt a.c. in this instance). The line on the left is usually considered "hot" while the one to the right is "cold," or ground, although in this application the circuit is not grounded to the box housing the controls since it will be handled by the operator. The box itself is grounded to an external ground as a protection against accidental shorts to the chassis somewhere in the box.

To arrange a control system using this diagramming method, it is only necessary to connect the components between the hot lead and the cold lead. Any intervening or interlocking switching functions then are provided at the appropriate point in the string between the two supply leads. This method of diagramming greatly simplifies control system design and interpretation.

Early in the design it was decided that both from the standpoints of safety and from the supression of TVI it was best to have nothing in the control box except control voltages and switches. In other words, the actual circuits are made or broken, as the case may be, by relays located in each chassis. Thus the lines from the control box to the chassis carry nothing but 110-volt a.c. control current, except in the case of the receiver control circuit. If the actual switching were carried on in the control box proper, the circuit currents would have to traverse the control leads between control box and transmitter leading to possible circuit loading effects, and in the case of r.f. circuits the leads would have to be by-passed and shielded to prevent possible radiation.

Hence, each separate chassis was provided with a 110-volt a.c. relay with its contacts arranged to turn the unit's plate voltage on when the relay was closed, and off when the relay was opened. The control circuit leads were brought out of the individual chassis by feed-through condensers which effectively by-pass the leads for r.f. at the point of leaving the chassis. (This was simply a precaution against the radiation by the line of any stray r.f. that it might have picked up inside the chassis. It can be eliminated if TVI is not a problem.)

The exception mentioned above in the case of the receiver control circuit was a result of bowing to the convenience of the external switching provision already on the receiver. This made available, through a pair of terminals on the rear apron of the receiver chassis, an opening in the B minus lead of the receiver for the purpose of controlling it by an external switch. This was used as the receiver designer intended.

The circuit which was evolved after much cut-and-try with a pencil is shown in *fig* 2.

After some playing with the circuit on paper it was finally decided that all of the switching functions could be resolved into three DPDT switches. (Triple pole switches were avoided since they are not stock items in many radio parts supply houses.) Although all of the switches are DPDT electrically they are all different mechanically. SW1 is DPDT center-off (sometimes called "three position") heavy-duty since all of the primary filament power flows through this switch in addition to the control power.

SW2 is the "Send-Receive" switch, again of the center-off type. This switch, known affectionately as the "big switch," was selected as a key-switch of the type used on telephone switchboards as a concession to the writer's

admiration for the smooth, quiet, positive action of this type of control. This switch with its larger lever achieves some prominence over the other two switches on the panel which is only proper due to its function.

Operation of the Circuit

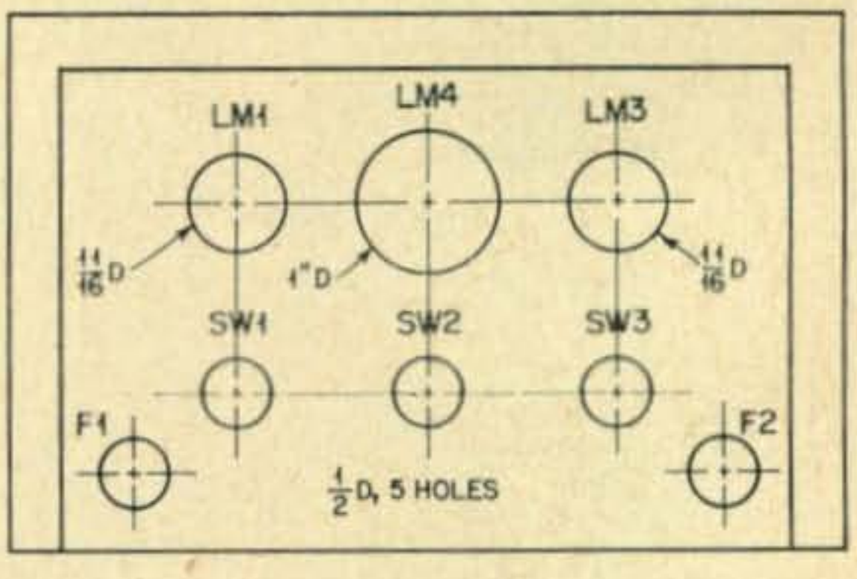
SW1, in the center-off position, prevents the application of either heater or plate voltage to the receiver or any of the transmitter circuits. In the up (Receive) position it actuates the receiver filaments, and in the down position it applies filament power to the receiver and all of the transmitter circuits; and it further activates the "Send" portion of the "Send-Receive" switch which is dead until SW1 is in the lower position.

A time-delay relay could be introduced in series with the lead from SW1 to SW2 if automatic warm-up delay time is desired. It was not provided here due to the cost and the writer's feeling that it was no great inconvenience to restrain himself from throwing SW2 until 30-seconds or so had transpired after turning on the heaters.

SW2 in the up position (Receive) applies plate voltage to the receiver only. In the down position (Transmit), it actuates all of the plate voltage relays in the transmitter. Thus, it effectively prevents the receiver and transmitter from being on simultaneously since the switch can be in only one position at a time.

SW3 in its normal position (down) permits SW2 to function normally. In its up position (Tune) (held up against the spring) it applies control current to the VFO relay only, if the receiver is on (SW2 in the Receive position). If the transmitter is on (SW2 in the Send position) SW3 is inoperative except that it will open the VFO control circuit if the switch is inadvertently moved to Tune. In a self-biased transmitter this could be a very poor feature, but in the writer's transmitter a clamp-tube is used to protect the final against failure of the excitation. Hence such failure is of no concern in this instance. In a self-biased transmitter this could be a matter of some concern, but "good" modern amateur transmitter design demands that the final tube(s) be protected with a clamp-tube or with sufficient fixed-bias to limit the plate current in the case of failure of the grid drive.

Two fuses were used to protect the circuits, a heavy one (2 amp.) protecting the whole system of filaments and controls, and a smaller one (.3 amp.) protecting the control circuit alone. Two fuses were felt to be necessary since the control circuit current is rather small compared to the heater primary circuit current. If both were protected by only the one large fuse, a small over-load in the control circuit could do quite a bit of damage before the main fuse would open the circuit. The second fuse is therefore inserted in the control circuit lead



Panel Layout

Parts List

SW-1—Heavy Duty toggle switch, DPDT, Center-off, Cutler - Hammer 7563-K4, Contacts rated 15 A @125V or equivalent.
SW-2—Key, or toggle switch, DPDT, Center-off, Switchcraft 6036L or equivalent.
SW-3—Toggle Switch, DPDT, two position, spring-return, Hart and Hegeman Type 21858-X, Contacts rated 3 A. @125V.
F-1—Fuse panel mounting with fuse of capacity to handle all filament primary circuits and control circuit.
F-2—Fuse panel mounting with fuse of capacity to handle control circuit current only.
LM-1, 2, 3—Neon Pilot Lamps, 110-volt AC, Dialco 25F415 or equivalent.
LM-4—Neon Pilot Lamp, 110-volt AC, 1-inch Dialco Type 431.
Box—5 x 6 x 4-inch aluminum Minibox.
2—Ten point barrier terminal strips, Jones 10-140.

only and is of a rating only slightly greater than the total control circuit current.

Indicators

Pilot light indicators were decided upon for the purpose of indicating to the operator when the unit was on, and for allowing a quick check of the position after any momentary diversion from the rig. Hence, it was decided that three primary functions were to be indicated by these pilot lights; Filaments On, Receive, and Transmit. The fourth lamp is discussed in the next section.

These indicator lamps could be the regular 6.3 volt a.c. pilot lamps in which case a small filament transformer should be incorporated in the box, and 3PDT switches should be used in place of the DPDT indicated in the diagram. This third set of contacts would then be used to switch on the appropriate indicator lamps associated with the actuation of each switch. However, in this case 110-volt a.c. neon lamp indicators were used for two reasons: first, no separate set of switch contacts was needed for the indicator circuits; and second, these lamps indicated that the control voltage was actually applied to the circuit since they are lighted by that same voltage and they therefore indicate more than simply that the switch is in proper position. The neon indicators were thus considered a more positive form of indicator.

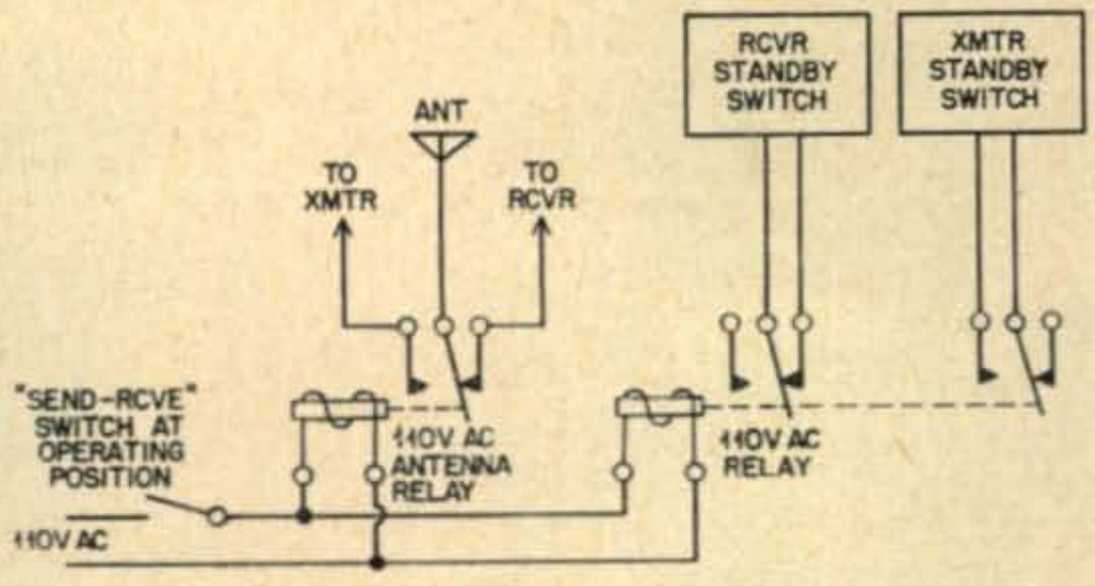
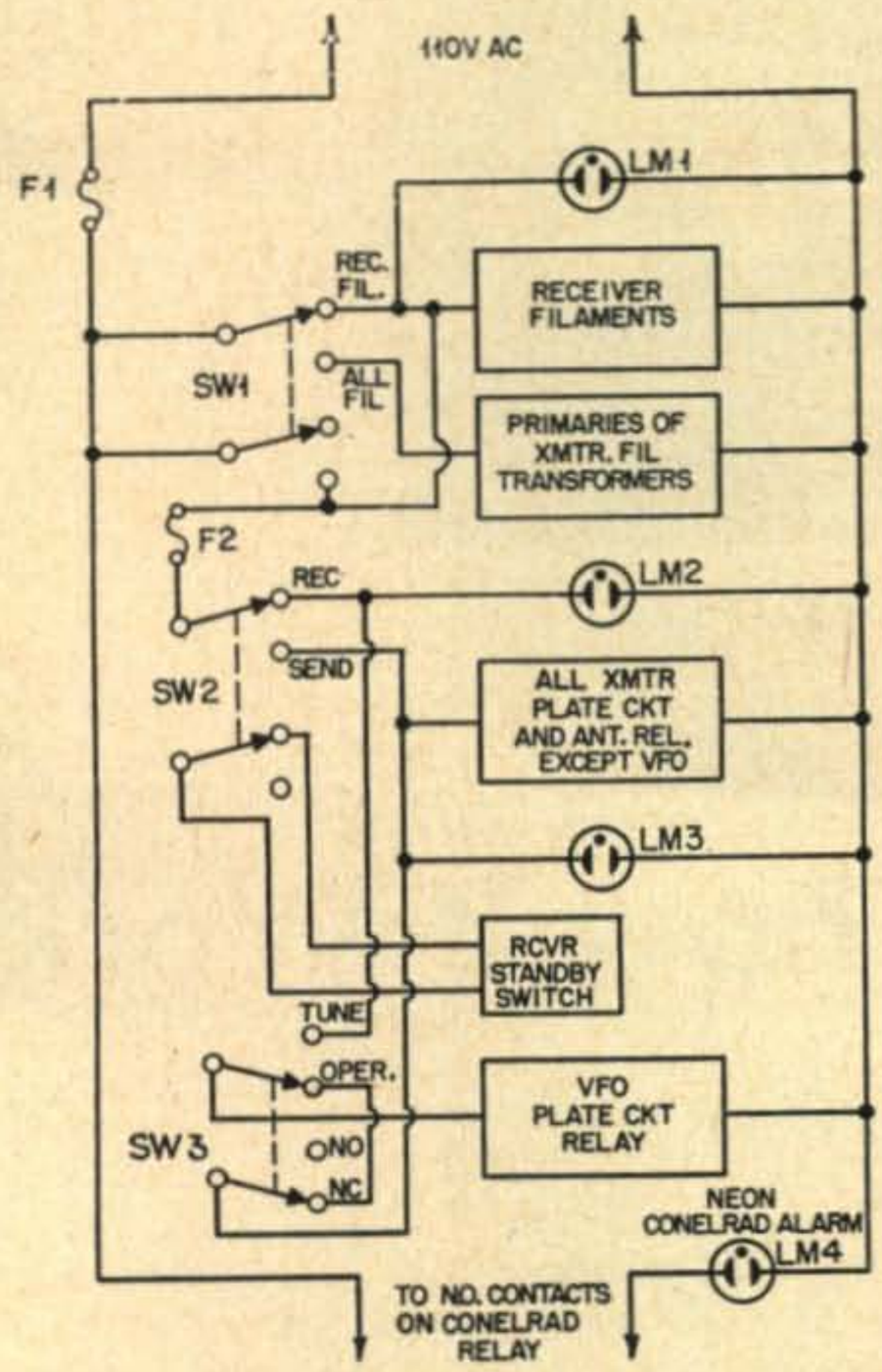


Fig 1 above, Fig 2 below. This diagram indicates 4 lamps but on the author's unit LM-2 (Receiver on) was left out.



The fourth indicator lamp, which is located at the top and in the center of the panel, is slightly larger than the other lamps to give it some prominence. It is the Conelrad Alert indicator. If desired, this circuit can be wired to open the transmitter control circuit automatically in the event that the monitored broadcast station goes off the air for an alert. But, the prominence of the light at the Send-Receive switch was felt to be sufficient to make the automatic feature unnecessary, and it would further free the transmitter from the possibility of being thrown off the air by accidental failures of the monitored BC station. If the automatic Conelrad feature is used, a "disabling," or "cancel" switch should be provided to inactivate the system during late-hour operation when the local BC stations may be off the air.

The Conelrad alarm itself can be any of the proposed units which are connected to a BC receiver in the shack and which close a relay when the BC station goes off the air. The particular one used by the writer, as described previously in *CQ* by W2EEJ, consists simply of a small selenium rectifier in series with a sensitive relay. A large value, low voltage, eletrolytic condenser is connected across the relay. This circuit is connected across the output transformer secondary of an AC-DC type receiver. The speaker is disconnected with a switch.

While the BC station audio is coming through the receiver, the condenser across the relay coil is kept charged by the audio signal current rectified by the selenium rectifier and this holds the relay closed. If the BC station goes off the air, its audio signal no longer appears across the condenser and the relay drops open, closing the Conelrad Alert contacts on the relay. This in turn actuates the Conelrad indicator lamp in the control box, or as previously mentioned the relay can be used to open automatically the transmitter control circuit.

Physical Features

The control system was constructed in a standard 5 × 6 × 4-inch aluminum Minibox. The components were mounted in the "u" shaped, one-piece, front and back panel so that the covering member could be removed for checking and servicing without disconnecting any of the wiring.

All of the external connections were made to a pair of barrier terminal strips on the back of the box. These were neatly labeled to facilitate connections or alterations of the system. All of the control cables were laced together and fastened to the back of the box with a cable clamp. This laced cable was then run down the leg of the desk and over to the transmitter.

The aluminum box contains so few components that it is quite light and was subject to being knocked about the operating desk. To prevent this a key-slot was cut in the bottom of the box so that it would fit over a small screw-head on the desk. It might have been screwed directly to the desk, or an upright; or future constructors might consider screwing a sheet of scrap lead in the bottom of the box to give it some stability.

Conclusion

The circuit outlined herein, together with its design principles and features, offers a control system that is adaptable to most amateur stations. It will more than repay the small investment and effort by its added convenience and safety. Operating with a good control system for only a few hours will lead you to ask how you ever managed to operate without one. ■

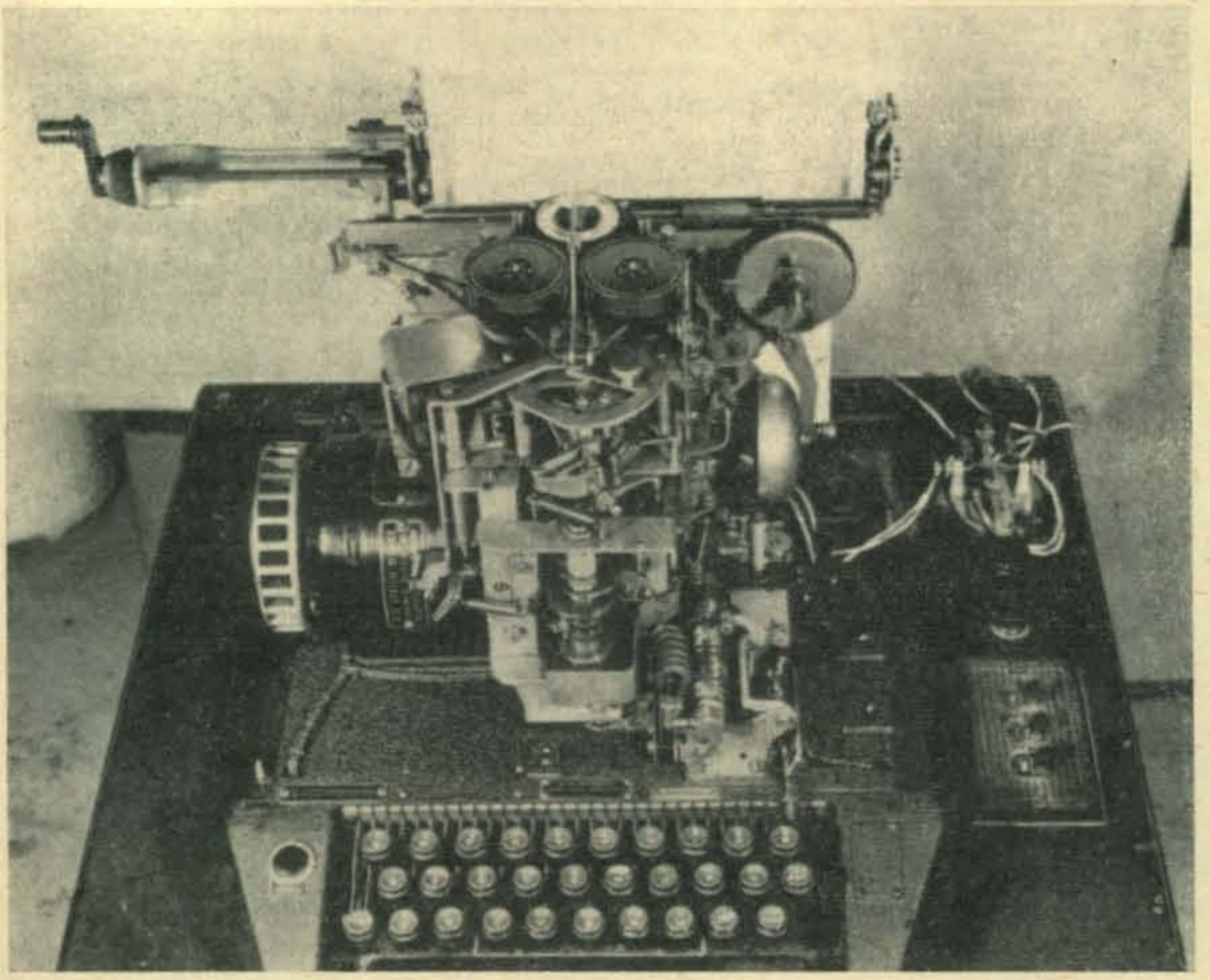


Photo 1

for teletypers . . .

the Model 26 and how It Works

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The Model 26 is a Teletype machine of relatively quiet, soundproofed operation. Most of these machines were in use during World War II and are now being replaced with newer Model 28's of 100 WPM speed. Thanks to W9GRW and others of the South Calif. RTTY Society, the 26 is becoming the machine most often encountered in Ham RTTY.

It is a "single selector magnet" machine that carries the type in two levels on a wheel that revolves, with vertical shift, until the correct pallet is in position to be butted from behind to print the letter. The "corncob" (or rubber covered roller) ratchets left to achieve letter spacing.

Photos No. 1 and 2 show the typewheel on top flanked by the ribbon spools. Just underneath on the left side is the mysterious selector magnet, protected from dust by a metal shield. A large synchronous, 60 cycle motor occupies most of the base, while deep down in the "basement" lives "the clutch"—Photos 6 center and 7. South by southeast of the ribbon spools is a metal scale and "range" pointer lever.

On the back of the outside case cover is a rubber lined hole intended for the insertion of a finger. Proper blind groping of that digit will result in the manual tripping of the carriage return and the "corncob" will slam to the right at break-neck speed.

I have been told that WØHZR has developed a device that automatically trips this return lever plus a line feed every time the right paper margin is reached. This is fine for copying weak signals through QRM with unattended machines.

Now then—let's shadow an RTTY signal, letter Y, through the printer.

A steady mark current signal is holding the selector magnet armature against the pole pieces opposing a 3-½ lb. pull of an adjustable spring. The machine is silent. At the first interruption of mark current, (start pulse) the magnet releases and a trip latch allows a six pointed cam to rotate one turn at a constant speed, driven by the 60 cycle synchronous motor. While the cam is turning, the selector

magnet is energized and de-energized by successive letter Y code pulses. Five decisions of a trip or no-trip nature are made according to the position of the armature during five intervals of cam rotation. The 6th interval is the "print" trip action. The action is similar to an auto ignition distributor. The "range" pointer allows adjustment for best results just like advance-retard in the auto distributor, however, it is distributing mechanical motions, not sparks.

The result is that if the speed of the rotating cam is close to that of the distant transmitting mechanism and the "range" pointer is set right, this device will translate the electrical signal from your receiver's terminal unit into five armature movements that are distributed to five mechanical finger movements corresponding to the code for the letter Y. This can be seen in Photo 5 where the ends of the levers show in "Y" coding position on the far right.

These five projecting levers are fine places to verify proper distributor action when trouble shooting.

These levers are trip latches and either are or are not tripped at the end of the cam rotation upon which another arm closes between them so that the decisions made are irrevocable.

The metal lever positions are carried around into the side of a barrel shaped container via pivots. This barrel container, located centrally in the printer, houses a series of washers with toothed edges. The nearest analogy to what happens there is that of the sensitive fingers of a Mississippi River boat "card shark" feeling a marked deck. The washers are shuffled mechanically and the fingers hold certain washers. The washers stop in a position such that only one of many springloaded metal rods around the circumference of the barrel can pop up past the toothed edges, where it acts as a stop against a moving arm causing the rotating typewheel to stop with the selected letter Y facing the paper. The "card shark" barrel has correctly selected the desired "ace" out of the coded lever positions fed it. The last act is to swipe some mechanical energy somewhere and "rake in the pot" (excuse me) and use it to bump the back of the Y pallet selected, thus printing and finally ratchet the "corncob" over a space for the next letter.

In actual practice, the 26 is printing the previous letter while decoding the current letter. Therefore, it is always printing one letter behind at maximum 60 WPM speed.

Some spots on the typewheel are blank. These are where the typewheel ends up when anyone of six functions, such as, carriage return, line feed, letters, figures, bells or stop, is received. These functions are taken off via levers on the lower right side of the printer which are tripped by prongs attached to the removable clutch assembly. See Photo 3—from top to bottom they are:

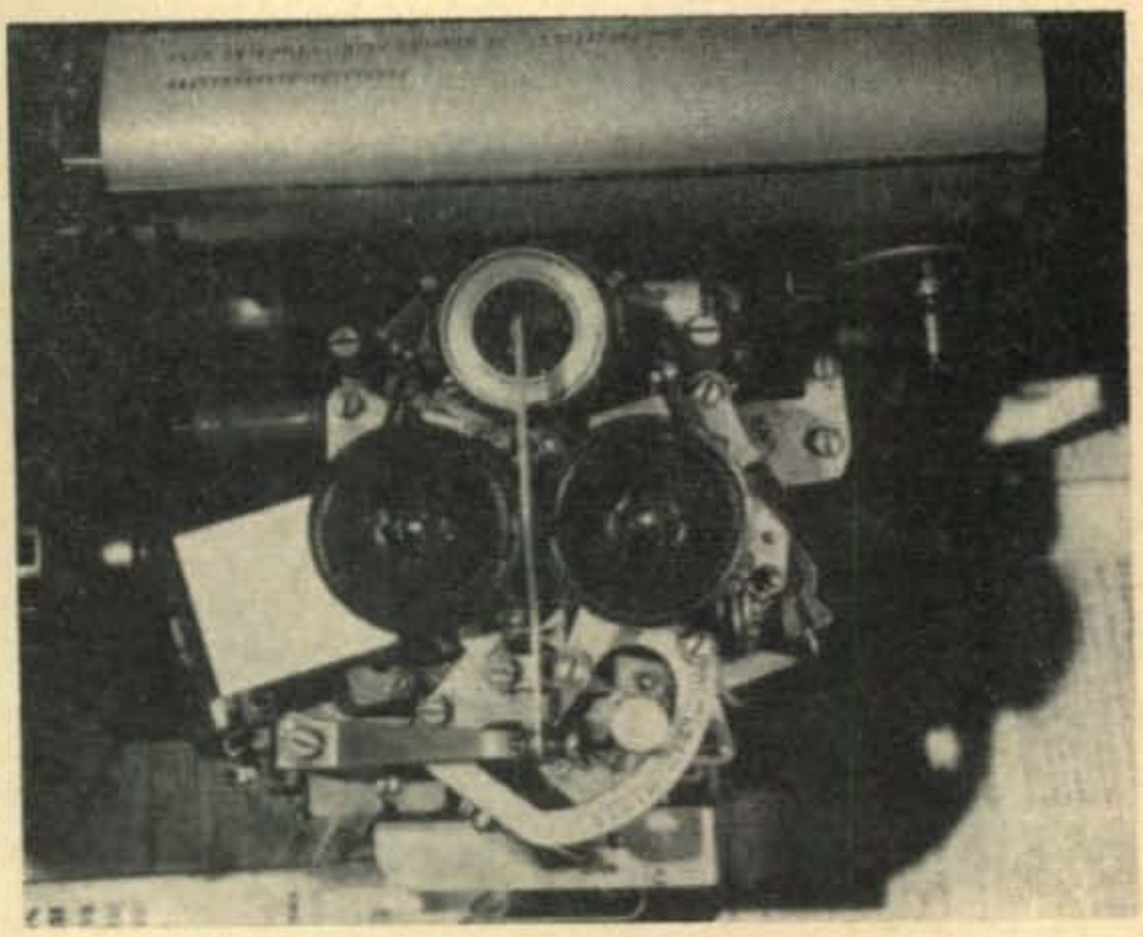


Photo 2

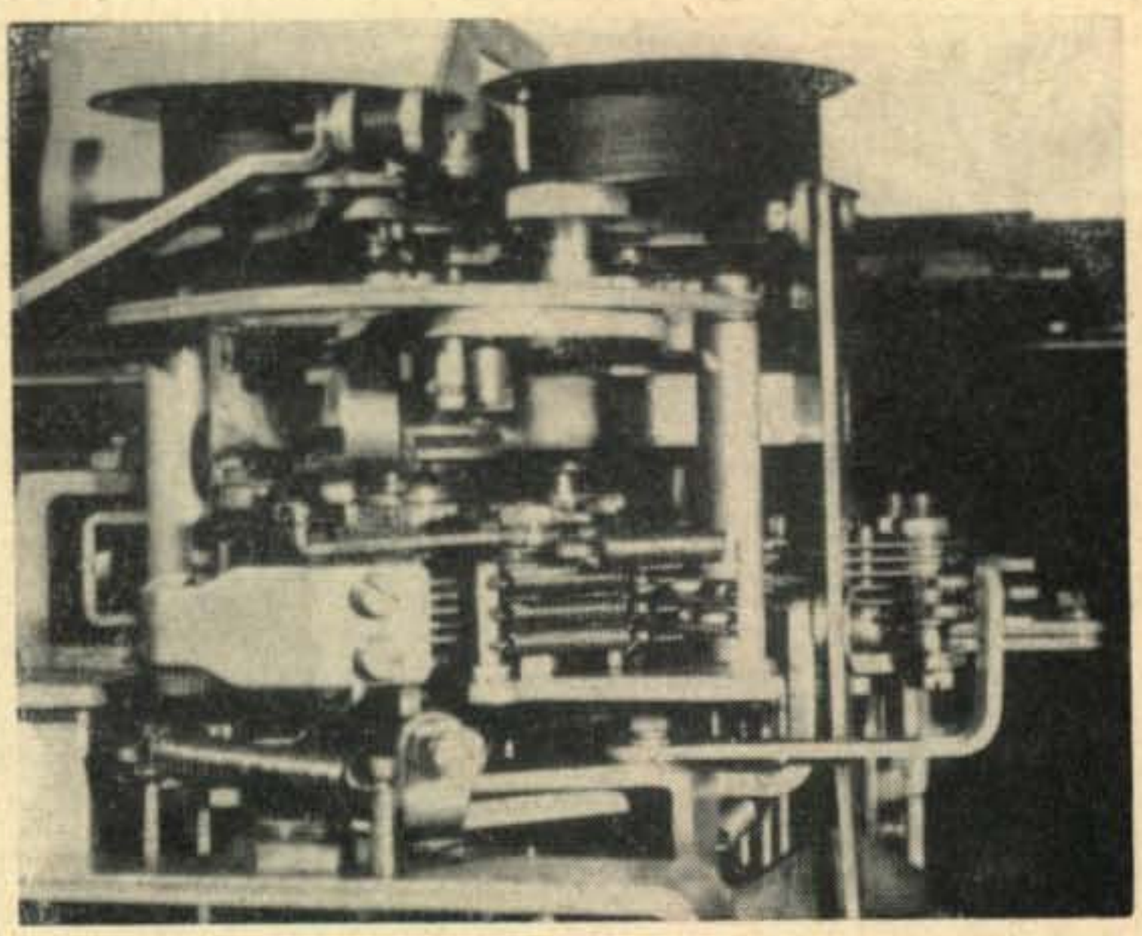
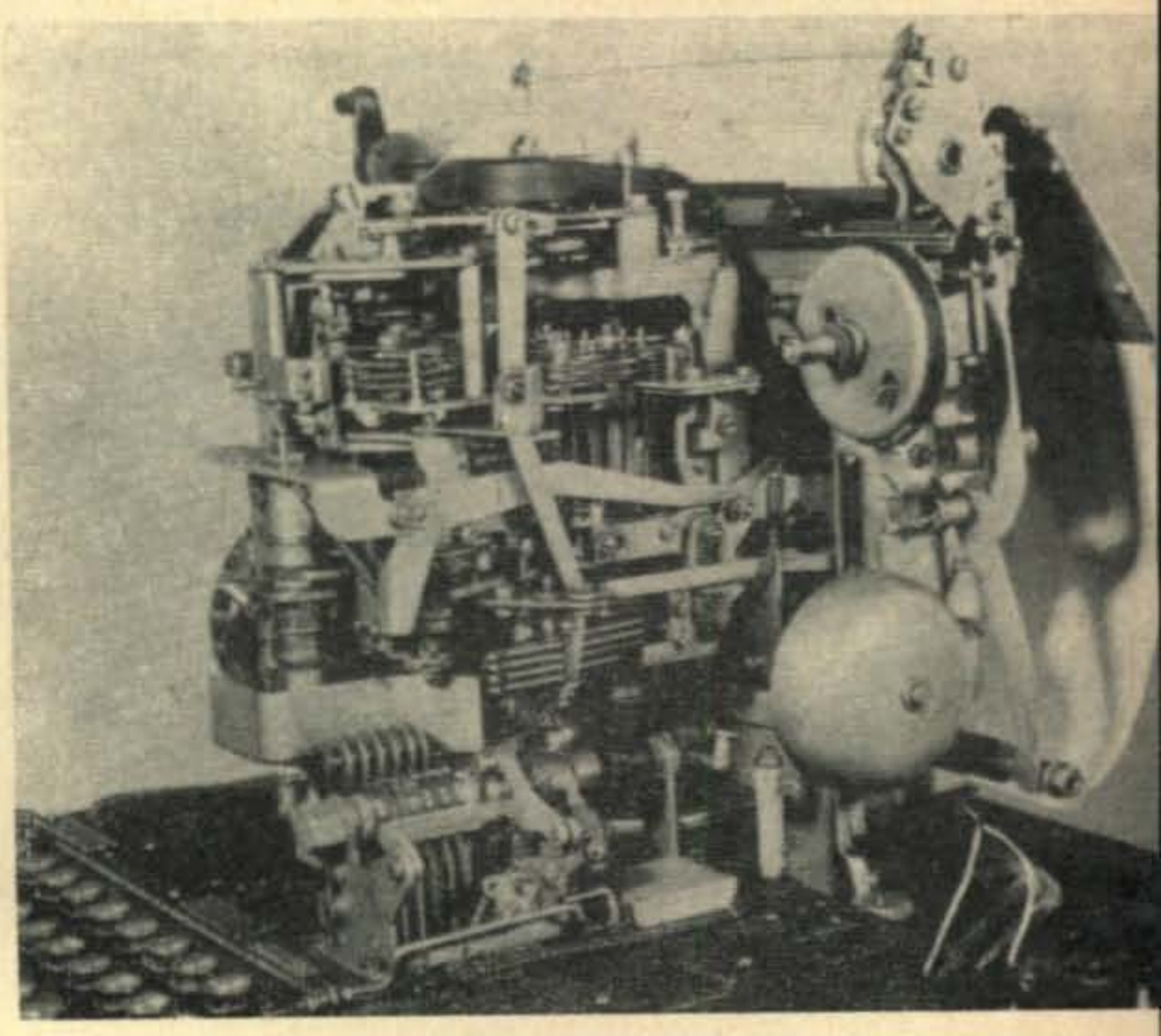


Photo 5—Code levers in letter "Y" position.

Photo 3—Function levers No. 2 thru 5 visible. No. 1 is hidden inside the machine and No. 6 is not on this machine



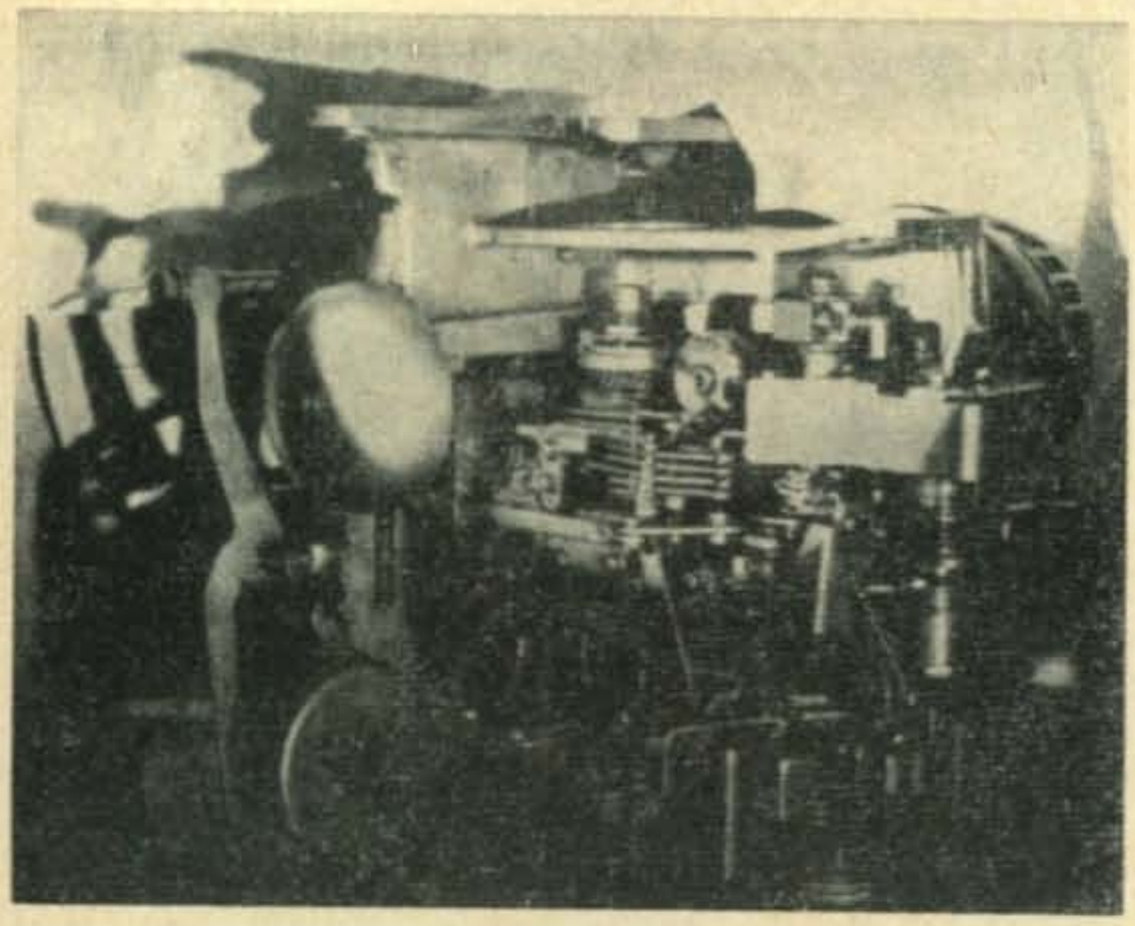


Photo 6

1. car return (hidden from view)
2. figures
3. letters
4. line feed
5. bell
6. stop (missing on my machine)

In most machines the last slot will be empty. It is stop, upper case H. If the missing lever can be obtained, it can be rigged to a switch and used to switch off the printer motor, receiver, or any old handy thing in autostart service. The Bell Telephone RTTY Serviceman's Book shows a lever and microswitch added as a kit to machines used in "TWX" service for unattended shutdown, upon reception upper case H.

Adjustments

The following adjustments and information are of most frequent interest and the experience of W2TKO, and a borrowed Bell Telephone RTTY Book of W2SSS was used compiling it.

1. The Clutch—Photo 7—is removed by first printing letter G so that the clutch set screw is in an accessible position, and then removing the printer from the base. Loosening the set screw will allow the clutch assembly to slide off the shaft into your hand. Never fear about correct replacement as it cleverly will go back only in the right way. Roy (W2TKO) lubricates clutches with plain No. 10 motor oil. Use fine instrument oil on the wicks if you are fussy. Soak them up good by gently prying the faces apart so that the oil will run entirely in. Be very careful not to mar the polished faces while doing so.

There is considerable heat developed in this slipping clutch. Some say that this is the point of most wear in the machine. Therefore, it is best to adjust the tension to just enough to do the job and no more. A too loose clutch will cause strange misprints on only certain letters and often the difficulty vanishes after frictional heat has tightened up the tension after a period of operation. Too tight produces good copy but wears felts out while generating excessive heat.

The favored method of setting clutches seems to be to adjust with the lock nut on the bottom until tight enough to copy the letters R and Y at maximum speed without mistakes. The letters R and Y are the two hardest letters for a printer to print alternately. They also have opposite RTTY coding like A and N in cw.

2. The selector magnet assembly consists of two coil magnets that can be strapped in parallel for 60 ma. or in series for 20 ma. operation. A 5000 ohm resistor bridges the coils for damping. Screw adjustments position the coils so that the armature just fails to touch the poles by about .010" when coils are mark signal energized. The pole pieces and armature must be clean. A deposit of oil or greasy dirt will hamper the quick release of the armature on space, thus goofing up the works. The Bell Telephone Manual states that the armature return spring should be set near 3½ lb. pull and implies that oil or grease on the pole pieces is the most frequent trouble encountered. Slightly different tensions may be tried for best results particularly in regard to "range."

3. "Range"—The range lever is the pointer on the 0-120 scale shown in Photo 2. It alters the starting point of cam revolution of the receiving distributor. RTTY signal pulses are 22 milliseconds long, but the trip/no-trip decisions are made in a much shorter time than that. Therefore, the actual decision is arrived at by sampling a portion of the 22 millisecond pulse only. If the range lever is about 20, the cam has a head start and the leading part of the RTTY pulses are used. If the lever is near 100, the cam is delayed and the trailing behind portion of the RTTY pulses are used.

Fed perfect RTTY signals, a good machine in adjustment will have a span of pointer setting within which it copies perfectly. The

[*Continued on page 181*]

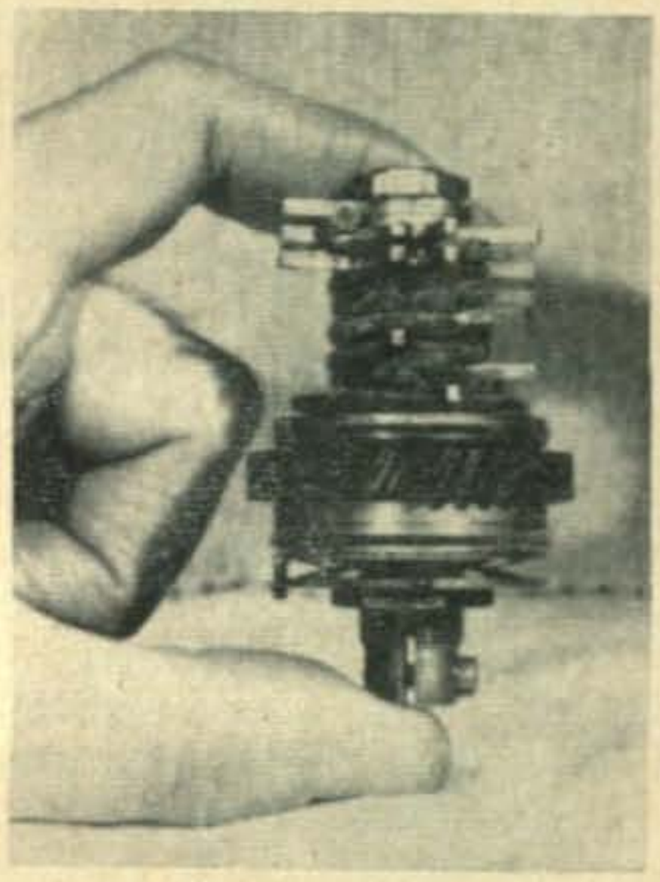


Photo 7
"the clutch"

Low Cost DSB-AM Amplifiers

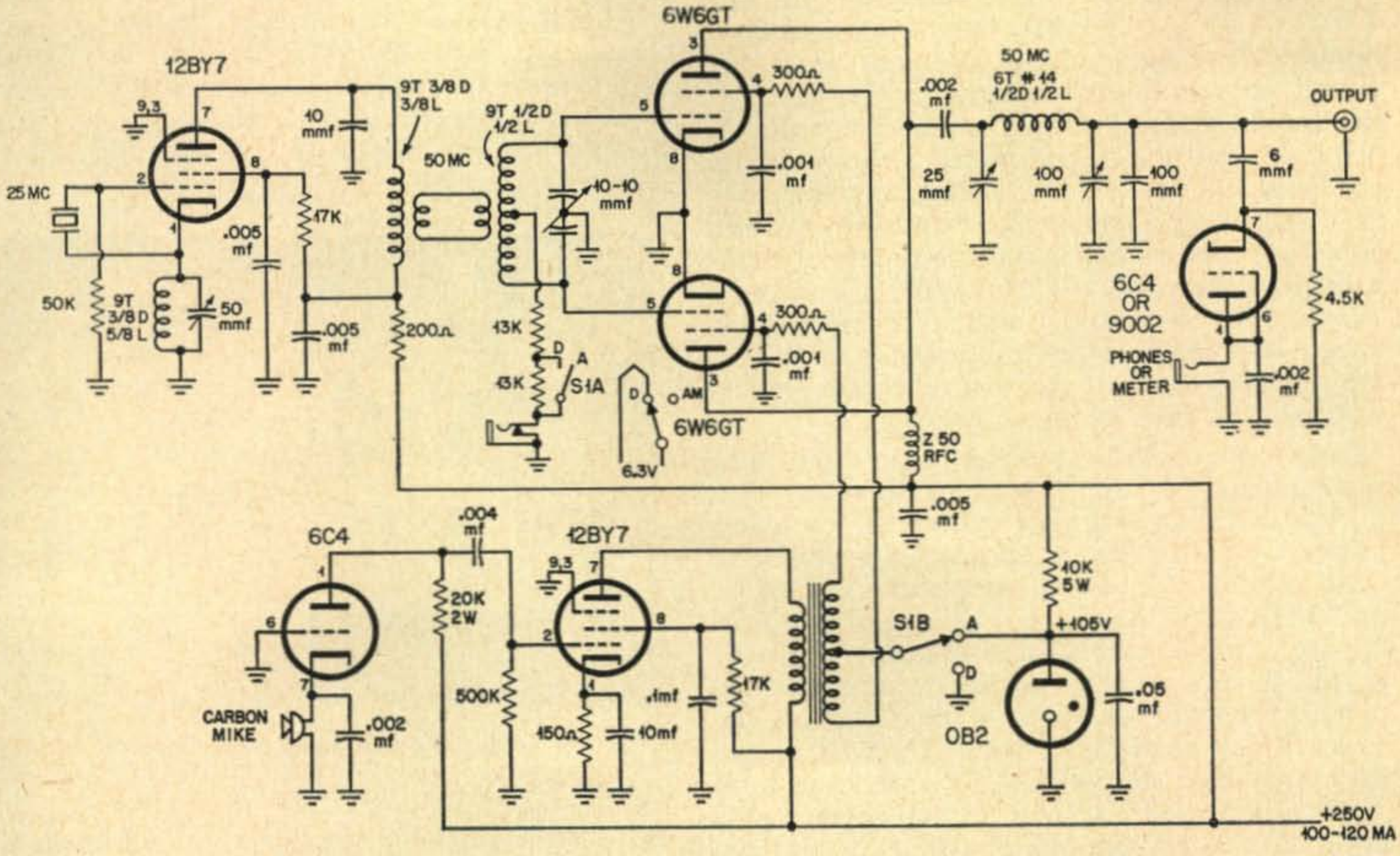


Fig. 1. 6 meter DSB transmitter. Note: the 12BY7 OSC plate tank coil is iron slug tuned.

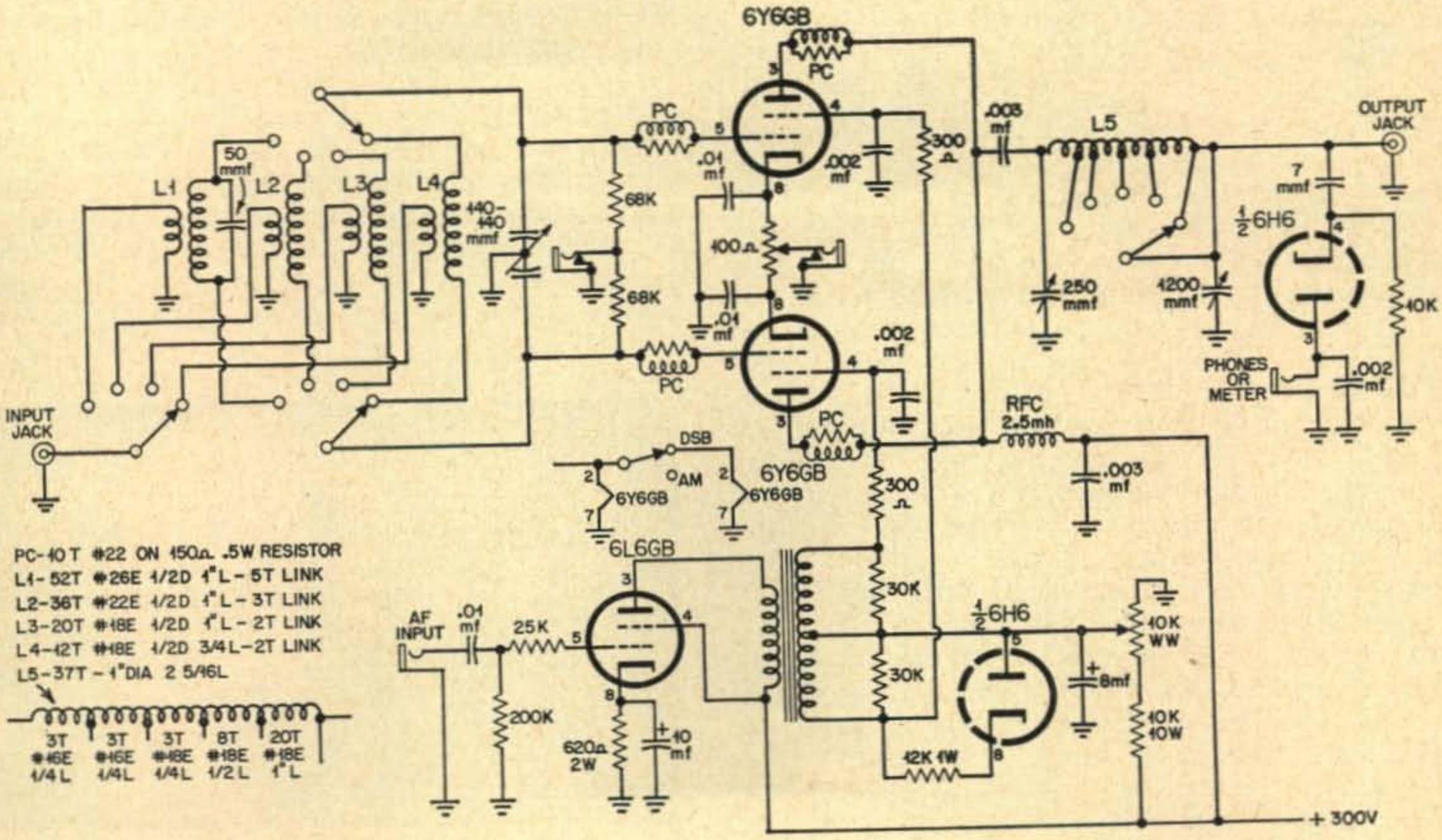


Fig. 2. An all band DSB generator amplifier.

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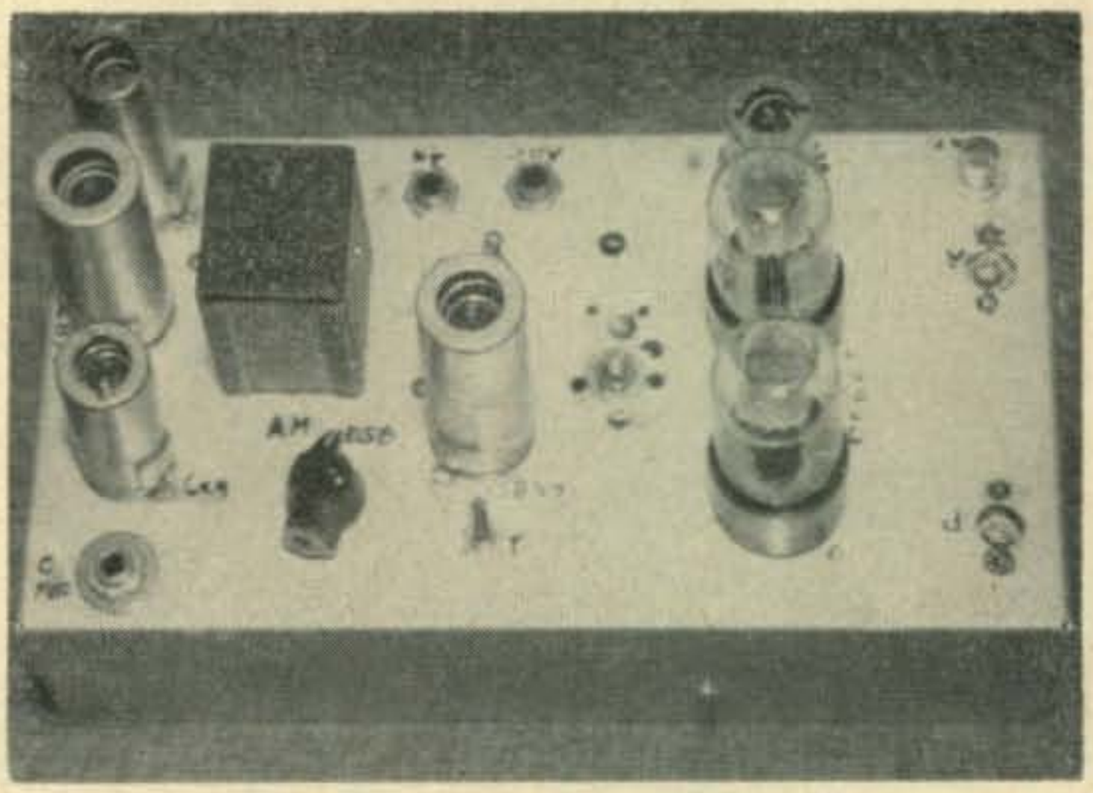
Sonoma, California

A DSB (double sideband suppressed carrier) amplifier normally uses two tubes connected with the rf guids in push-pull, the plates in parallel, and the screen-grids in push-pull. This rules out the use of tubes such as a dual tetrode 6360, 832, or 829, since a common screen grid connection prohibits push-pull audio input to the screen grids. Push-pull audio is needed in order to get the right phase conditions for double sidebands and still balance out the carrier. Push-pull rf grid connections with parallel plates permits balancing out the rf carrier signal providing the two class C rf tubes are alike. A 50 or 100 ohm potentiometer connected between cathodes provides a quick way of balancing out the carrier if the two tubes are slightly dissimilar in their characteristics.

In going over both transmitting and receiving tube tables, the smaller cost of receiving type power tubes looked very attractive for a low powered transmitter or an exciter for a large class AB_1 or AB_2 linear amplifier. The 6CL6 or 6AG7 tubes have too high a mu for DSB service at moderate dc plate voltage. A 6V6GT or 6L6G looked more attractive but tests indicated that the dc plate voltage needed was at least 500 volts for 5 to 10 watts rf output during modulated periods. Further tube table studies indicated that the 6Y6G tubes had a desirable mu for operation with plate supplies of 250 to 300 volts. At these moderate values of plate voltage, the rf output of a 6W6GT is over twice as much as with 6V6GT tubes and the same held true for 6Y6G tubes as compared to 6L6G tubes.

Two rf amplifiers and modulators were built to try out these tubes. One using 6Y6G or 6Y6GB "rf" tubes and a 6L6GB modulator was made to cover the range of 3.8 to 30 mc with band switching coils as shown in fig 2. The other was a complete 50 mc transmitter with 6W6GT tubes as shown in fig 1. This transmitter could be used for fixed station or mobile service. 12 volt car systems would mean the use of 12W6GT tubes, series heater connection in the 12BY7 modulator, and a 12 volt triode in place of the 6 volt 6C4 microphone amplifier. Either unit can be used for DSB or for screen grid modulated AM with carrier and sidebands. In the latter service, one rf tube has no heater voltage applied so it acts solely as a neutralizing capacitor for the "hot" tube. In DSB operation each tube acts to neutralize the other since the af signal switches one tube then the other into operation to supply rf output. The dc screen voltage is zero for DSB operation so no output from either tube takes place except on positive af cycles. One tube only is supplying rf output at a time, so the other one acts as a neutralizing capacitor at the instant. The neutralization is satisfactory in both transmitter in the frequency range of 50 to 3½ mc.

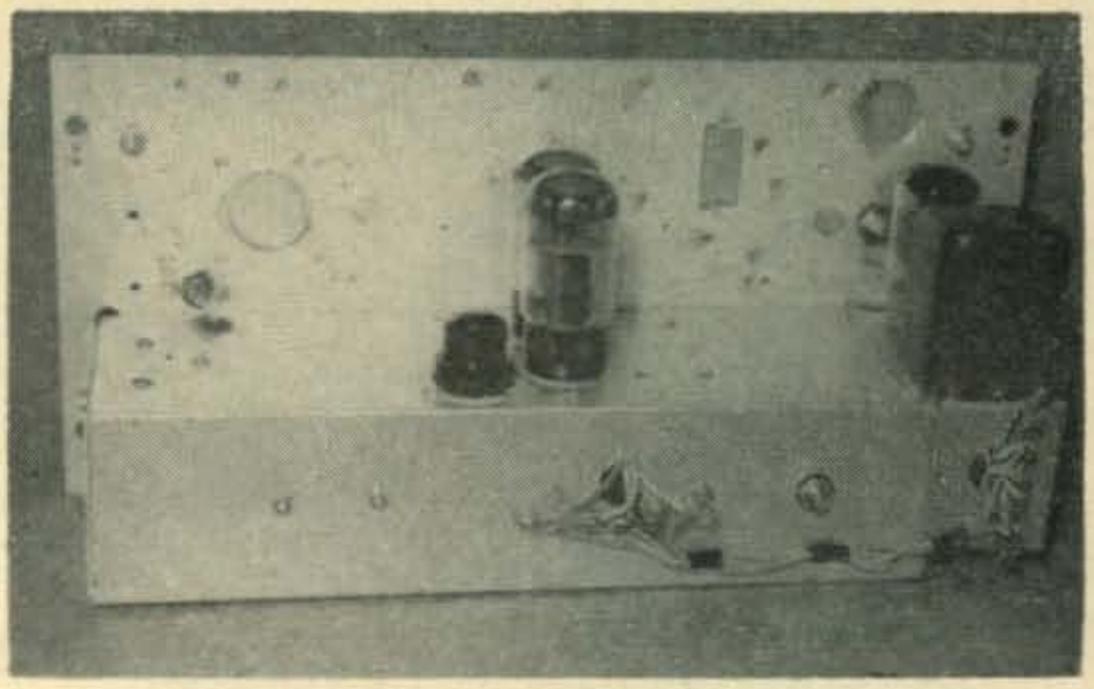
The 6W6GT and 6Y6GB tubes have a very high Gm and are subject to UHF parasitic oscillation. The 50 mc unit shown in fig 1 did not have parasitic oscillations, however another similar unit on 50 mc with 6Y6G tubes required parasitic suppression. The rf grid and plate suppressors for 50 mc were made by winding 6 turns of #22C. on a half watt 150 ohm resistor (connected in paralleled). The parasitic suppressors for the 29 to 3.8 mc unit had 10



Top view of 6 meter transmitter.

turns on a 150 ohm resistor as shown in fig 2.

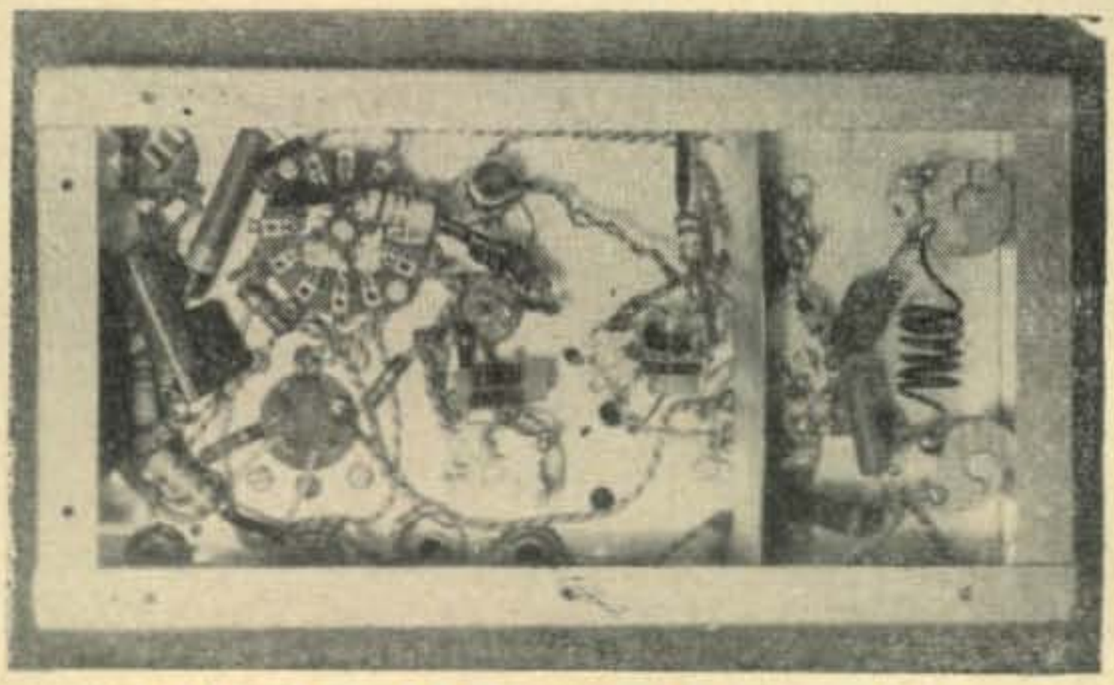
The 50 mc transmitter shown in fig 1 and photographs, used 25 mc overtone crystals of a type which would double in a 12BY7 tube tritet oscillator to 50 mc. This drives the 6W6GT tubes in push-pull through link coupling. Any unbalance in the grid circuit can be balanced out with a small capacity from one grid or the other to ground. For DSB operation this is necessary. In the unit shown, the slight balancing effect was obtained by pushing a grid lead of one 6W6GT closer to the chassis than the other. A radio receiver coupled directly to the output jack across a 50 ohm resistor (with *no* modulation present) makes



Back view of all band DSB amplifier.

a useful device for balancing the DSB stage in either transmitter. This balance is essential for good DSB suppressed carrier operation but does not apply to AM with normal carrier operation.

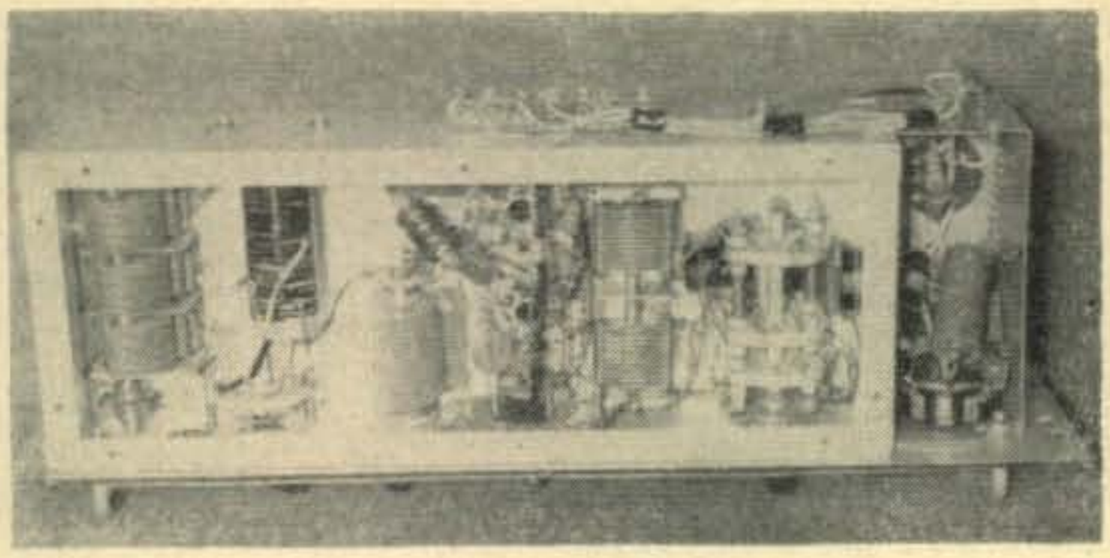
The unit of fig 1 uses a carbon mike driving a 6C4 or similar grounded grid triode. This type of input will not usually supply more than 2 or 3 volts peak af to the modulator tube, so a 12BY7 was used as a modulator rather than the more popular type 6AQ5. The 12BY7 requres much less grid voltage for the same output of 2 or 3 watts. The modulator tube has to supply the 6W6GT screen grid power for DSB, and the audio modulating



Underside of the 6 meter DSB transmitter.

power for AM to one 6W6G. For AM a fixed DC voltage of about 100 volts (from an OB-2 regulator tube) must be switched into the circuit at the same time the heater supply to one 6W6GT tube is switched off. A 3PDT wafer switch accomplishes all functions. The modulation transformer was a small push-pull output transformer reversed, with a turns ratio of 1 to 1 for each half secondary winding to the primary. A class AB_1 driver transformer with a turns ratio of 1 to 2 total with a CT secondary may be used. The DC resistance and current capacity of the windings of an ordinary push-pull interstage transformer are not suitable for this service.

During DSB operation the two screen grids of the 6W6GT tubes are driven in push-pull by the audio power tube. For AM operation one 6W6GT tube is not operating due to the heater being off, so only half of the output



Underside of the all band DSB exciter.

transformer is supplying audio power to the 6W6GT screen grid. The audio power requirements are a little less on AM than on DSB. The rf tube plates are in parallel which lends itself readily to the use of a pi-network for coupling to an antenna or to a higher powered linear amplifier.

For convenience in tuning up on AM a diode (or diode connected triode) was connected across the coaxial output jack as shown in both fig 1 and 2. The output jack permits connection of a headset for monitoring the af quality on AM, or a 0 to 3 ma. meter for checking the rf output on either AM or DSB. The same milliammeter can be plugged into the grid leak circuit of the rf stage for tune up procedure. The dc grid current on AM should be about one ma., and about 2 ma. on DSB.

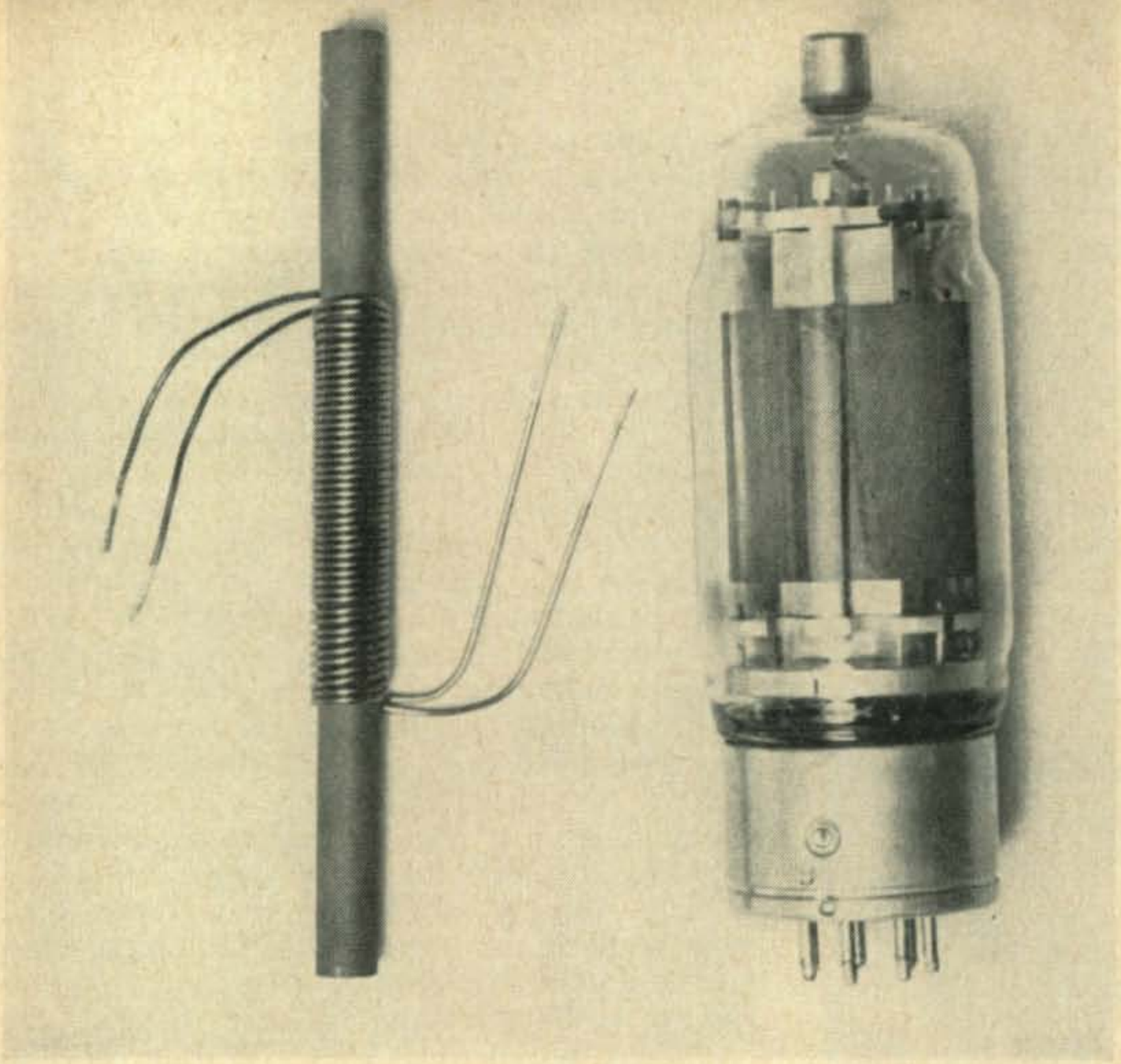
If a 0-100 ma. meter is connected in series with the +B lead to the rf stage below the shunt feeding rf choke, the meter will read about 40 to 50 ma. for a 6W6GT tube on AM. For DSB operation the reading will be zero with no modulation and kick up to 50 or 60 ma. when modulating. The 6Y6G or 6Y6GB tubes having greater plate dissipation ratings, can be used with a little higher plate voltage and the current readings can be 25 to 30% higher than with 6W6GT tubes.

The measured output of the 50 mc transmitter was 4 watts into a 50 ohm dummy antenna. The larger unit had measured outputs of from 5 to 8 watts in the 3.8 to 29 mc ranges. These were measured values on AM only. No peak outputs were measured on DSB but the values were estimated to be from 5 to 15 watts peak.

The complete 50 mc unit (except for power supply was built into a 5x9½x2½ inch aluminum chassis with bottom cover for shielding. The total power supply requirements are 6 or 6.3 volts at 3½ to 4 amperes, and 250 volts at 100 to 120 ma.

The lower frequency unit was built into a 5½x13x3 inch chassis with side bracket bent up of aluminum sheet for the modulator. This was mounted on a well used 375E tuning unit plug-in panel for connection into the lower frequency transmitters at W6AJF which can be used as linear amplifiers as well as in class C. The 6L6G modulator requires an audio peak voltage of about 20 volts from a separate speech amplifier, preferably one with a compression or limiter built into it. The 6L6G tube on AM operation was able to produce negative peak clipping and rf splatter effects, so ½ of a 6H6 dual diode was connected through a 12,000 ohm resistor across half of the modulation transformer to give some added load to the modulator on high negative peaks. This practically eliminated the splatter effects on AM without excessive load on the modulator for DSB operation. The dc screen voltage is

[*Continued on page 111*]



Not an ignition bomb, but a filament choke that you can build for less than a dollar. The tube is an 813.

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Nashua, New Hampshire

a Filament Choke for Grounded Grid

Did you ever stop to consider that SSB with all of its complexities is responsible for bringing to light a very simple power amplifier? The grounded-grid linear amplifier is a natural for top honors in the simplicity sweepstakes until someone figures out how to do it with diodes. If your pet bottle has a cathode, things are extremely simple; but all of the high power transmitting tubes create a problem because there isn't any cathode to be driven. Now that the cathode has been eliminated, the only place left to apply drive is the filament.

The filament can be driven quite efficiently by using a low capacity filament transformer, but it just doesn't seem fair to let a mere filament transformer dominate the final. The monsters are comparatively expensive too, even on the surplus market.

The first attempt to overcome the drive problem was to drive the center tap of an open frame filament transformer. This worked very well on 75, but the drive requirement increased fifty percent on 40. The most logical solution seemed to be a broad-band choke which would cover the three to thirty megacycle range. After all, we have been using broadband plate chokes for years. Unfortunately, the chokes designed for plate circuits will not stand several amperes of filament current; and even if they would, the voltage drop would be excessive. The required choke should have a high impedance for efficient drive, and a very low resistance for negligible filament voltage drop.

The input impedance of a grounded-grid power amplifier is quite low; and if zero-bias triodes are used, it should be less than 200 ohms. A choke of ten times this impedance (2000 ohms) would drain off ten percent of the drive. A few quick calculations indicated that approximately fifty feet of wire would be required to maintain a reasonable impedance at three megacycles, and #10 wire would be necessary to maintain the required very low resistance. That is quite a coil no matter how you wind it; but a high permeability core should permit a coil of reasonable dimensions. A search through several ferrite catalogs for a core that might do the job resulted in an unexpected bonanza. Almost all of the ferrite rods produced for broadcast antennas have a high permeability at ten megacycles. One manufacturer claimed that his antenna rods were usable at thirty megacycles. Right at this time, a catalog arrived from Lafayette Radio; and it listed an antenna rod that looked promising.

The dimensions (½" x 7½") were not optimum (1" x 4"), but the price was too low to resist; so two rods were ordered for tests. The first winding met the impedance requirements, and series resonance was at fifty-eight megacycles. A signal generator was matched into a 150 ohm resistor, and the voltage drop caused by shunting this resistor with the choke was observed with a vacum tube voltmeter. megacycles, and almost imperceptible from twenty-two to three. The drop was only five percent at twenty-nine megacycles. A quick check in the rig turned out to be a permanent installation, because forty watts input to the 6146 drove the 813 to slightly better than 400 watts input on 75, 40, and 20. The filament voltage drop cannot be measured on my voltmeter, and the calculated resistance is slightly less than 0.02 ohms.

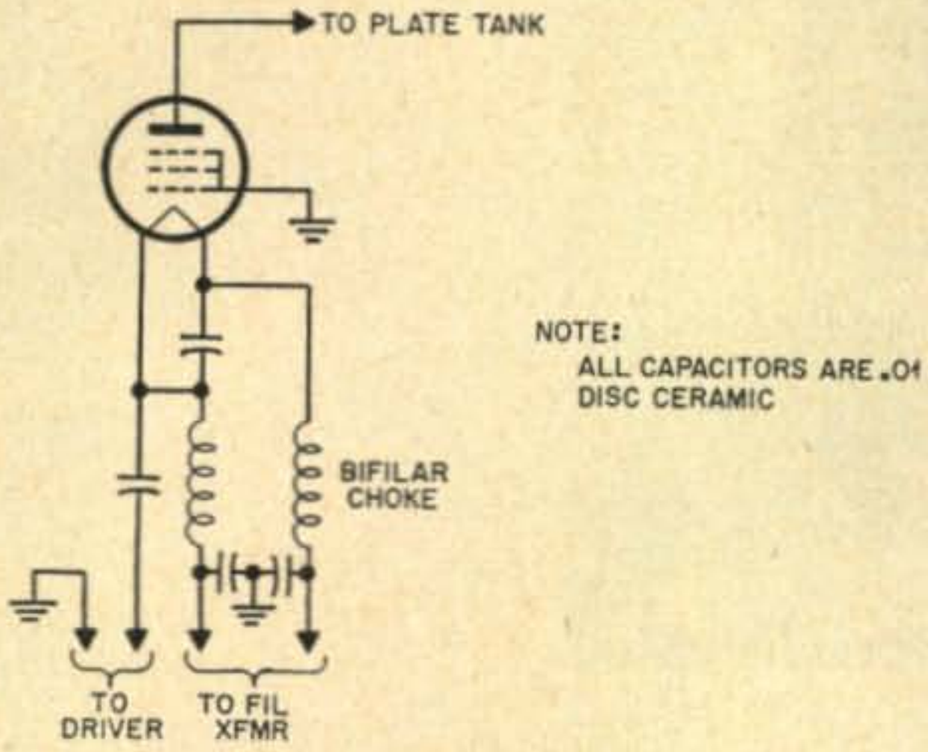


Fig 2. Method of connecting the choke.

The choke consists of twenty-one turns of #14 enamel, bifilar wound; and if bifilar winding confuses you, visualize a coil wound with twin lead or refer to fig 1. The recommended winding procedure is as follows: Take two straight pieces of wire about four feet long and tape them together at each end making sure that they are parallel. Clamp one end of this two-conductor wire and a half-inch dowel securely in a vise. Now closewind twenty-one turns onto the dowel. Remove the dowel and insert the ferrite core. That is all there is to it; you now have a bifilar filament choke. A neat installation can be made with two cable clamps and two standoff insulators.

Drive is applied to the choke through a .01 mmfd capacitor (see fig 2), and matching is easy if your exciter has a pi-network output, or you can do things the hard way by adjusting the tap on the plate coil with the high voltage OFF.

There is very little published information on grounded-grid linear amplifiers, so the results of my investigations might be helpful. The cheapest and easiest way to go grounded-grid is with a zero-bias triode. All pentodes and beam tetrodes make excellent zero-bias triodes with all the grids and beam plates (if any) connected together. The 803, 813, 814, and similar types are probably better for this type operation than the more modern tetrodes such as the 4-250. The reasoning behind this is that the older type tubes have a more rugged control grid. Just because the grids are tied together does not mean that the grid current divides equally among them. Actually the control grid still draws approximately eighty percent of the grid current. Another excellent reason is that the 803 and 814 are selling for less than two bucks at some surplus houses. The 813 is somewhat higher, and the only reason it is used here is that two were lying around gathering dust.

Swamping is not necessary because it is already there disguised as feed-through power. This is overlooked by most proponents of grounded grid; but it is definitely true and it appears to be the controlling factor as far as linearity is concerned. To put it simply: the higher the ratio of feed-through power to actual grid driving power, the better the linearity.

Neutralization and parasitics should not be a problem because two or three grids tied together form an excellent shield between the plate and cathode. Also, the output capacity will be approximately half the published value for any given tube.

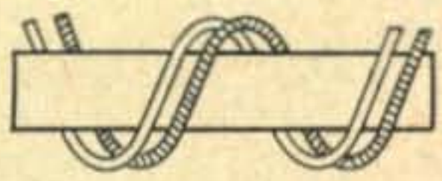
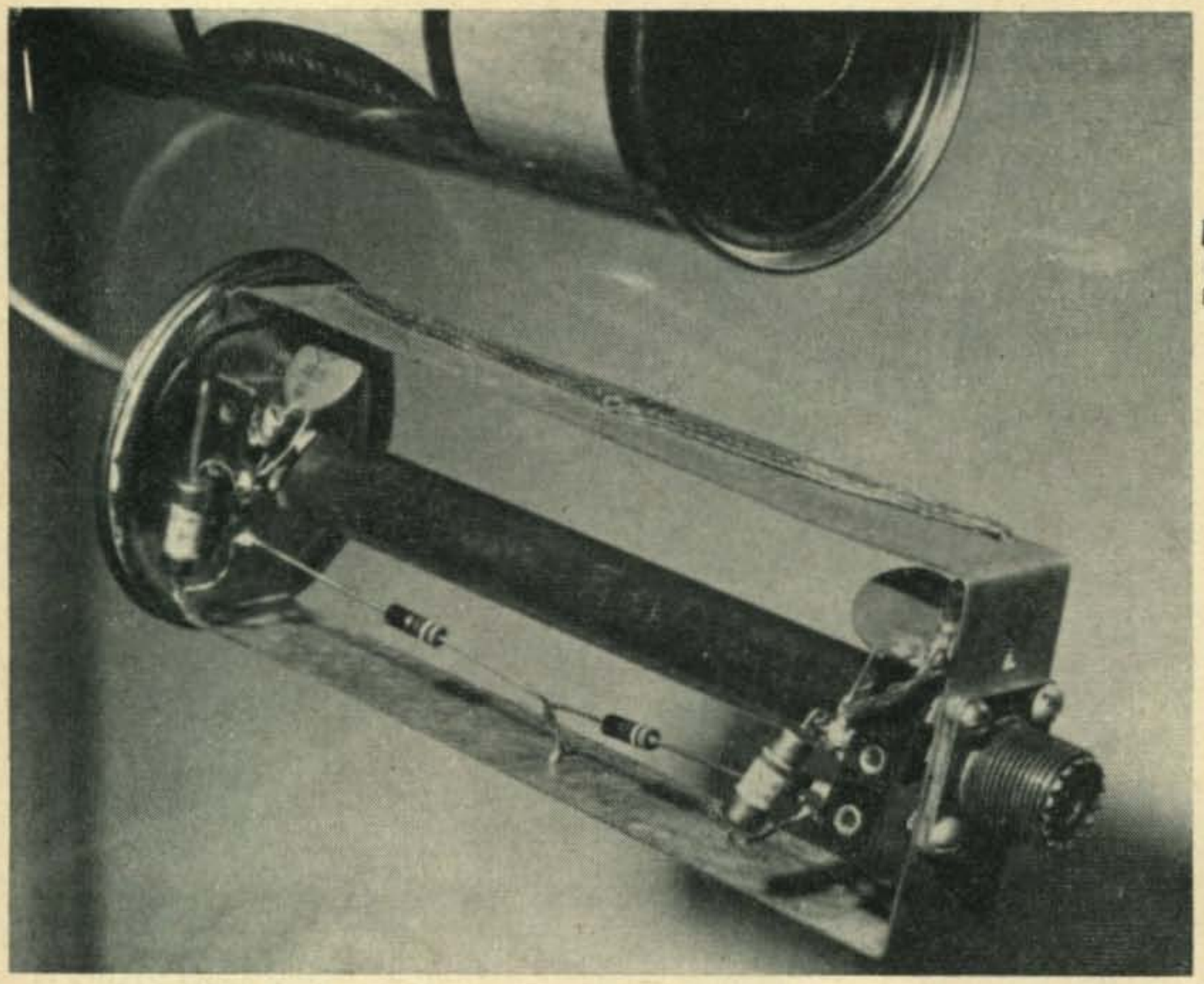


Fig 1. Pictorial representation of bifilar winding.

To those who cry "drawing grid current causes TVI," please remember that grid current is drawn for a full half cycle and not in short pulses. A brief reading on the theory of frequency multipliers should settle this issue.

The 813 here operates with 2200 volts on the plate and a static plate current of thirty mils kicking up to 200 mils on voice peaks or cw. The peak grid current is twenty-five mils. The calculated feed-through power is eighteen watts and the calculated grid drive is two watts. These figures are not necessarily accurate but they are representative. The 6146 driver has 600 volts on the plate and draws seventy mils on peaks with an estimated plate efficiency of sixty percent. W1WCR inherited the second model of the choke and immediately tied it in to a pair of 814s. He reports 200 watts into light bulbs with an estimated twenty watts drive from a 6L6.

As with any linear amplifier, initial tuning and loading should be done with the assistance of an oscilloscope. Just remember to touch up the exciter tuning every time the final loading is changed. Do not apply drive with the plate voltage off because the grid current will be excessive. ■



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P.O. Box 55
Pompton Lakes, New Jersey

the Beer Can S.W.R. Monitor

The conventional methods of measuring standing wave ratio in a transmission line with a low power bridge are known to most of us. However, there are several disadvantages to using this type of check: 1. The procedure is quite time consuming. 2. It is inconvenient if fast tune up on many frequencies is desired. 3. It leaves the system completely unchecked between tune-ups. Ideally, the measurement should be made at full power with a continuous reading instrument that can be left in the line at all times. The little device described below fills this bill and in addition is simple and easy to build.

Essentially the unit is a directional coupler with two identical bridge circuits one reading outgoing and the other reflected power. The coupling is obtained in an enlarged section of co-axial conductor containing the bridge elements. No direct connection is made to the center conductor and the power consumption or losses in the unit are negligible for all practical purposes.

We will not go into a lengthy description of how this gadget works but believe the following explanation will suffice. Referring to *fig 1*, resistors R1 and R2 act as two independent coupling networks sampling output power and reflected power separately. The directional properties result from the fact that the capacitive and inductive coupling to the line provided by the leads and stray capacity of each resistor are in phase in one case and of opposite phase in the other. Thus in the loop connected to the load or antenna end of the device the developed voltage and current samplings cancel each other when the line is properly matched. At the same time on the transmitter end they add. In this way the readings indicated on the reflected wave bridge can be made always comparative by first adjusting the potentiometer R3 to give full scale reading at any particular power input on the power reading side of the bridge. More about adjustments later.

The biggest job in building this device is the mechanical structure. A pretty fancy unit can be constructed if machine shop facilities are available to the builder. However, as most of us do not have such equipment we have worked up this "beer can" version which brings the project down to the kitchen table and can opener level.

One special point—the beer can used is extra long and is sold in this area as the "King-Size." Actually any can or metal container 6 inches long and 2½ inches inside diameter will work. An extra can any length, same diameter is also required.

In addition to the outer shield, two other structural parts are required. A strip of sheet material (copper, brass or galvanized iron) 1″x17″x0.025″ and a 5 inch piece of ⅝ inch O.D. copper tubing.

Construction

With these parts and two SO-239 co-ax fittings, construction can be started. First, the "opened" end is removed from the long can by sawing off the rolled end 1/16 inch in from the shoulder. Then a ⅝ inch diameter hole is drilled in the center of the other end. This is all that is done to the outer shield at this time.

The undamaged end of the second can is similarly removed. This end piece is used to mount the works.

The bottom from the second can is drilled to take the co-ax connector and the meter leads (#10 drill). The flat strip is folded to form a rectangular frame 6 inches long and 2-5/32 inches wide. By making the joint come at the center of one end, the co-ax connector holds the loop closed. A small (#35) hole is drilled at the center of one long side of the loop to mount the resistors. This done, the loop is secured to the can bottom with the co-ax connector screws holding everything together including a two terminal tie point. The other co-ax connector is similarly mounted at the other end of the loop with a symmetrically located tie strip. The photo shows the location of these parts.

Now for the center conductor. Copper caps are soldered over the ends of the ⅝ inch copper tubing. These caps and the tubing were obtained from the local plumbing supply house. Then a #40 hole is drilled in the center of each cap and a piece of #12 bare copper wire passed through from one end to the other. About ½ inch is left exposed at each end and the wire is soldered in place. With a little trimming of the wire leads, the center rod is soldered between the insulated terminals of the connectors. This completes the mechanical work.

The electrical components are wired in accordance with *fig 1*. The location of the two resistors R1 & R2 is critical. They should be carefully mounted so as to obtain precise symmetry and equal coupling to the line. The spacing of these resistors should be adjusted to give a 1:1 reading on the meter when working a 53 or 75 ohm feed line into a pure resistance load of the same value. Very satisfactory results can be obtained without this calibration if the two resistors are mounted with an air gap of ¼ inch between the surface of the center conductor and resistor body. The 1N35's and bypass condensers are mounted in conventional fashion to the tie points. The rectifiers should be kept as far as possible from the center conductor.

Connection to the indicating instrument is made with shielded 2 conductor intercom lead. Alpha #475C was used here. About 7 or 8 inches of the outer plastic cover is skinned off and one conductor fished through the shield at the end of this cover. The lead remaining in the shield is connected to the far end 1N35 while the unshielded lead is terminated at the near end 1N35. To reduce the possibility of r.f. pick-up on the long lead in the can it is wrapped around and secured to the outside of the support strip.

To enclose the structure, yet permit easy access to the interior, the long can is slipped over the support "U" with the co-ax connector projecting through the ⅝ inch hole. Then two holes are drilled through the can bottom on either side of the connector and on through the support strip—being careful not to drill into the rectifiers or terminal strip! Two self tapping screws are set in these holes to hold the outer shield to the inner structure.

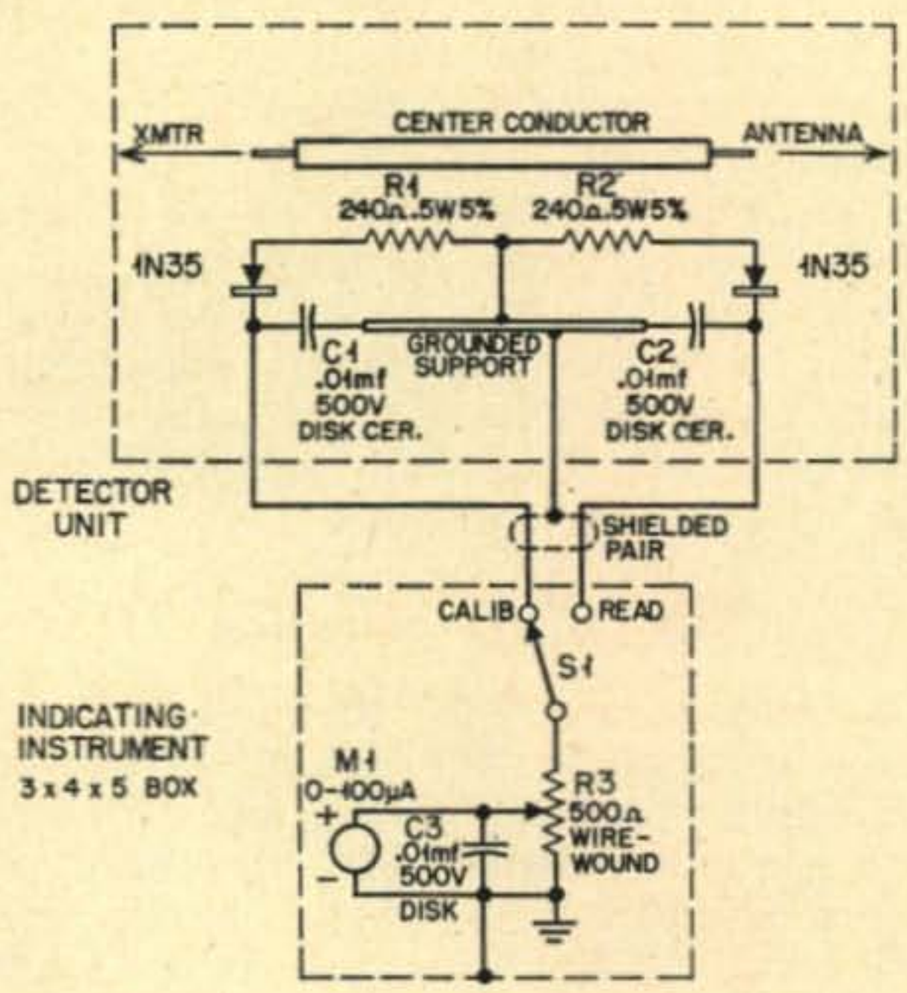

Fig. 1

The meter, adjusting potentiometer and check switch are all mounted in a 3x4x5 utility box. The shielded lead should be cut to reach from the spot in the transmitter where the detector unit will be connected over to the operating position. By locating the meter where it is easy to see, the SWR can be continuously monitored.

To place the unit in operation a short piece of co-ax, 75 ohm or 53 ohm, equipped with PL-259 connectors is required. With this cable the coupler is placed in series with the antenna lead. The adjusting pot is set to min-

[*Continued on page 180*]

Vertical Ground Plane Antenna, The Easy Way:

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Wnchester, Va.

Many amateurs have completely overlooked the power gain possible by switching from horizontal to vertical polarization when working mobile stations from the home QTH. Many times signals which are "down-in-the-mud" when working a horizontal beam against a vertical mobile whip will come in Q-5, R-9 when the base station switches to vertical polarization. One reason for this has been the difficulty of fabricating and installing an efficient ground plane vertical. However, since most hams already have horizontal beams for their favorite bands the author began looking around for some method of using the present beam as the ground plane for an efficient vertical antenna and the antenna described in the following paragraphs and shown in the photos was finally evolved.

If you already have a 10, 15, or 20-meter beam this vertical can be fabricated and installed in less than two hours. The necessary parts can be "scrounged" from junk television antennas. If no old TV aerials or aluminum tubing are available, thin wall electrical conduit makes an excellent substitute.

Theory of operation

This antenna uses the Unipole Principle, meaning in effect that the radiator is half of a folded dipole and therefore one end of the loop can be grounded directly to the boom of a plumbers delight type of beam, thereby maintaining complete lightning protection for the station equipment from electrical damage due to lightning striking the antenna radiator. The boom and elements of your present beam form the ground plane for the vertical radiator.

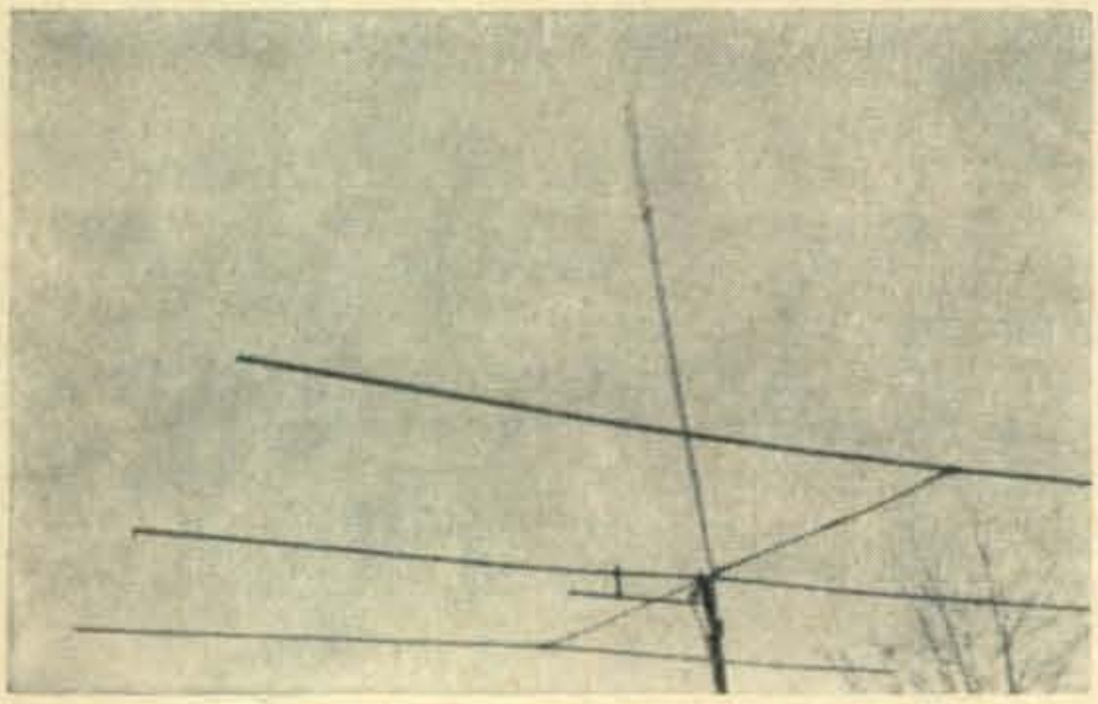
The only critical points are that the elements of the present beam must equal at least a quarter wave from the center of the vertical to the outermost corners of the present beam at the frequency used, ie. you have to use a 10-meter beam for the ground plane for a 10-meter vertical, not a 10-meter beam for the ground plane for a 20-meter vertical, etc.

The driven element must be ¼ wave long at the operating frequency. The length can easily be figured from the handbook formula:

$$\frac{246}{\text{Freq. (mc)}} = \text{length of a quarter wave in feet.}$$

Spacing between the sides of the loop should be about 3 inches. Anything from 2 to 4 inches may be used without appreciably impairing performance. If desired the antenna may be cut to your pre-determined frequency and installed without any method of frequency adjustment. However, it is suggested that a method of frequency adjustment be provided. See *fig. 1*. The side of the loop that is grounded at the bottom is made slightly longer than necessary and is slid through the clamp used to attach it to the boom of the present beam. Since the top of the present beam and the point at which the clamp makes electrical ground to the vertical determines the effective length of the vertical, it will have no effect on performance if the remaining portion is allowed to extend below the present beam. If the bottom end of the tubing happens to be crimped closed as it is on so many pieces of salvage antenna tubing, be sure to drill a small hole at the bottom to allow water to escape, otherwise water seeping down at the adjustment point will gather in the bottom and subsequent freezing will split the tubing.

The adjusting sleeves are made from 10 inch pieces of the same diameter tubing as the rest of the loop. These are then split down one side with a hack saw and spread open until the ends of the sections of the loop will just slip into it with a force fit. The clamps are made from pieces of 1 inch wide plumbers pipe hanger strap. In addition to providing a means of adjustment, use of sleeves provides a means of splicing several old TV aerials into lengths long enough for the loop. Once installed the effective length of the antenna may be varied by sliding the tubing in and out of the sleeve until the antenna takes maximum power at the desired frequency, after



which the clamps may be securely clamped in position.

The antenna adjustment can *best* be accomplished with the aid of a grid dip meter coupled loosely to the 52 ohm coaxial feed line. Attach the coaxial line to the antenna and then at the transmitter end wind a two or three turn coil, soldering one end of the coil to the center conductor and the other end to the outer shield of the feed line. Couple the grid dip meter loosely to the coil and then prune the antenna length until maximum indication on the grid dip meter is obtained at the desired frequency.

Parts required:

Enough tubing, either salvage aluminum from old TV aerials, new aluminum tubing, or thin wall electrical conduit to make the vertical loop. This will require about 20 feet for 10 meters, allowing for enough to make the adjustment sleeves and the amount to extend below the ground clamp.

One medium-heavy feed through insulator to support the driven end of the loop.

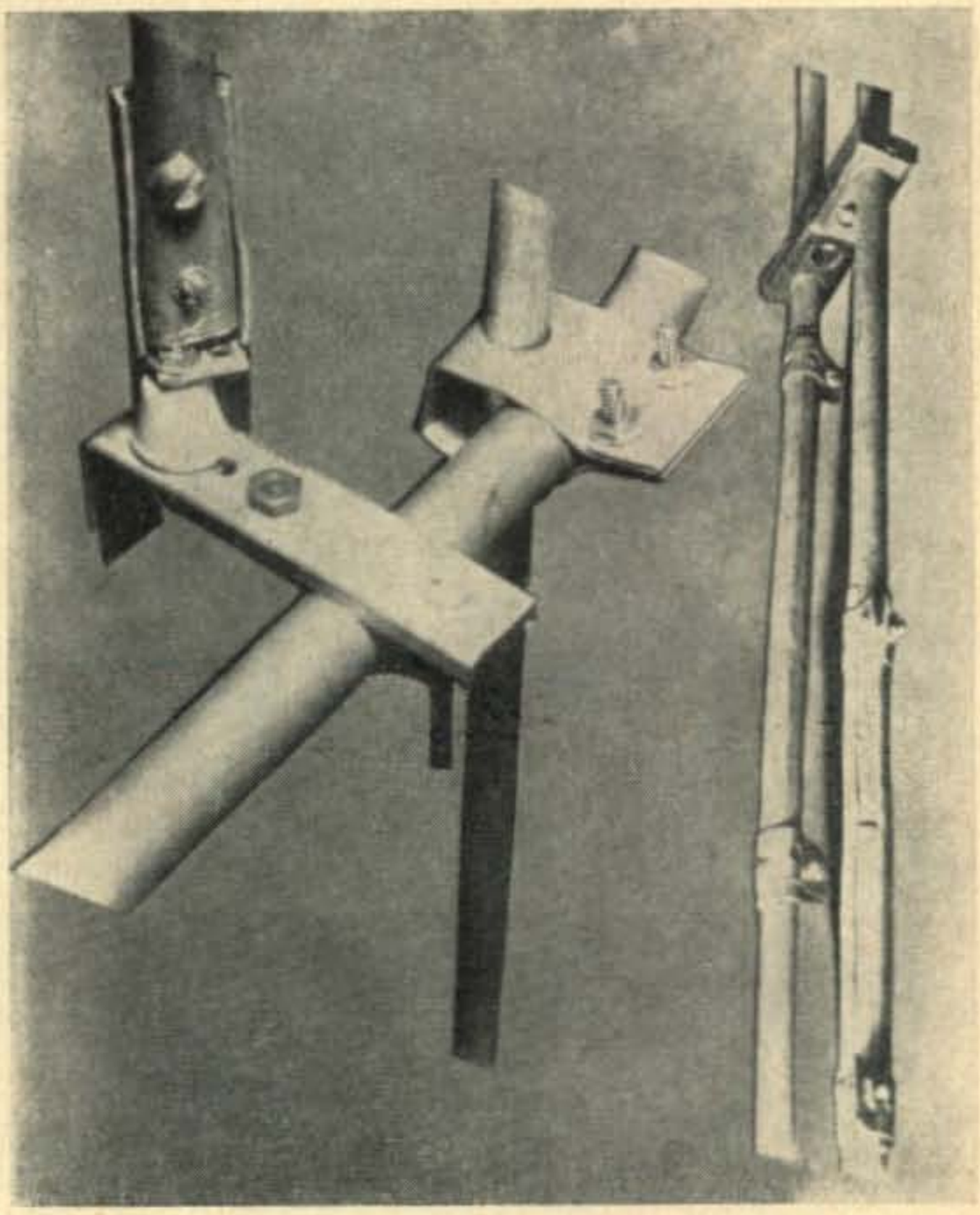
A quantity of aluminum bolts if aluminum tubing is used, or brass bolts if other tubing is used.

An insulating block to be placed between the sides of the loop about half way up. This is used to add rigidity to the loop and prevent twisting in the wind.

Enough heavy aluminum strap to make the ground clamp and support clamp for the driven end of the loop. (Most hardware stores now carry the "Do It Yourself" aluminum supplies and aluminum bolts, screws, angle, tubing and sheet stock is available at very reasonable prices from that source.)

Aluminum has a tendency to set up chemical action wherever it comes in contact with a dissimilar metal. For this reason it is advisable to use aluminum bolts and aluminum clamps if aluminum tubing is used for the vertical. In the event you find it necessary to bring metal other than aluminum in direct contact with the aluminum, it is suggested that the entire assembly be sprayed with several coats of plastic sprays available from most radio supply stores. This will protect the joint from the elements and retard any corrosive action.

Mount the vertical so that it grounds to the present boom at the physical center of the present beam. It is also suggested that the clamp holding the grounded side of the loop be oriented so that the portion of the unipole extending below the present beam is on the rear side of the driven element of the horizontal beam rather than in front of it.



Close up view of assembly used to clamp driven and ground ends of Unipole Vertical to boom of present beam, showing adjustable clamp for grounded end of vertical and also method of supporting driven end of vertical. Coaxial center conductor attaches to bottom of feed through insulator shown and coaxial shield attaches to bent down lip by means of bolts through holes shown, beow insulator to left. Also shown is a close up view of method of adjusting length of both sides of loop. Insuatng block shown at top is used to add rigidity to vertical and prevent twisting in wind. The adjustable sleeves are made from 10 inch pieces of the same tubing as driven element. The 10 inch pieces are split down one side with a hack saw, then spread until tubing will slip into them with force fit. Clamps shown are made out of 1 inch wide plumbers pipe hanger strap.

The antenna should be fed directly with RG-8-U or equivalent 52 ohm coaxial cable. The antenna provides a good match to 52 ohm cable so the length of the feeder is relatively unimportant. The shield of the coaxial cable is grounded directly at the mounting clamp and the center conductor attached to the feed through insulator supporting the driven end of the loop.

This unit presents a very excellent improvement over the usual vertical whip or over trying to work vertically polarized stations with a horizontal antenna; and best of all: It's simple, cheap, and can be assembled in practically no time without in any way impairing the performance of your present beam. ■

The Courteous S-Meter

H. D. Irvin, K2ZFB
307 Stirling Rd.,
Watchung, N.J.

The signal-strength meters supplied on communication receivers have not kept pace with modern amateur operating practice. Receiver manufacturers themselves obviously are aware of this fact, for most of them have taken a small corrective step. Whereas some years ago all S-meters were marked (with simple eloquence) from zero to S-9, nowadays the practice is to extend the range upward to at least 40 or 50-db above S-9. The manufacturers are to be commended for their effort, of course, but it has not been sufficient. A bold and sweeping departure from the past has become necessary.

After years of operating and listening on various bands, the writer concludes that not only should the S-meter have greater range, but also the region of the scale below S-9 is unnecessary and undesirable. Two excerpts of signal reports given by amateurs in phone contacts will demonstrate this.

Example 1. Boy, you've got a terrific signal there, old man . . . 60-db over . . . the meter is really pinned . . . real Q-5 . . . By the way, I didn't quite hear the handle and QTH . . . so, over to you again . . . I'm pretty sure your call is . . ."

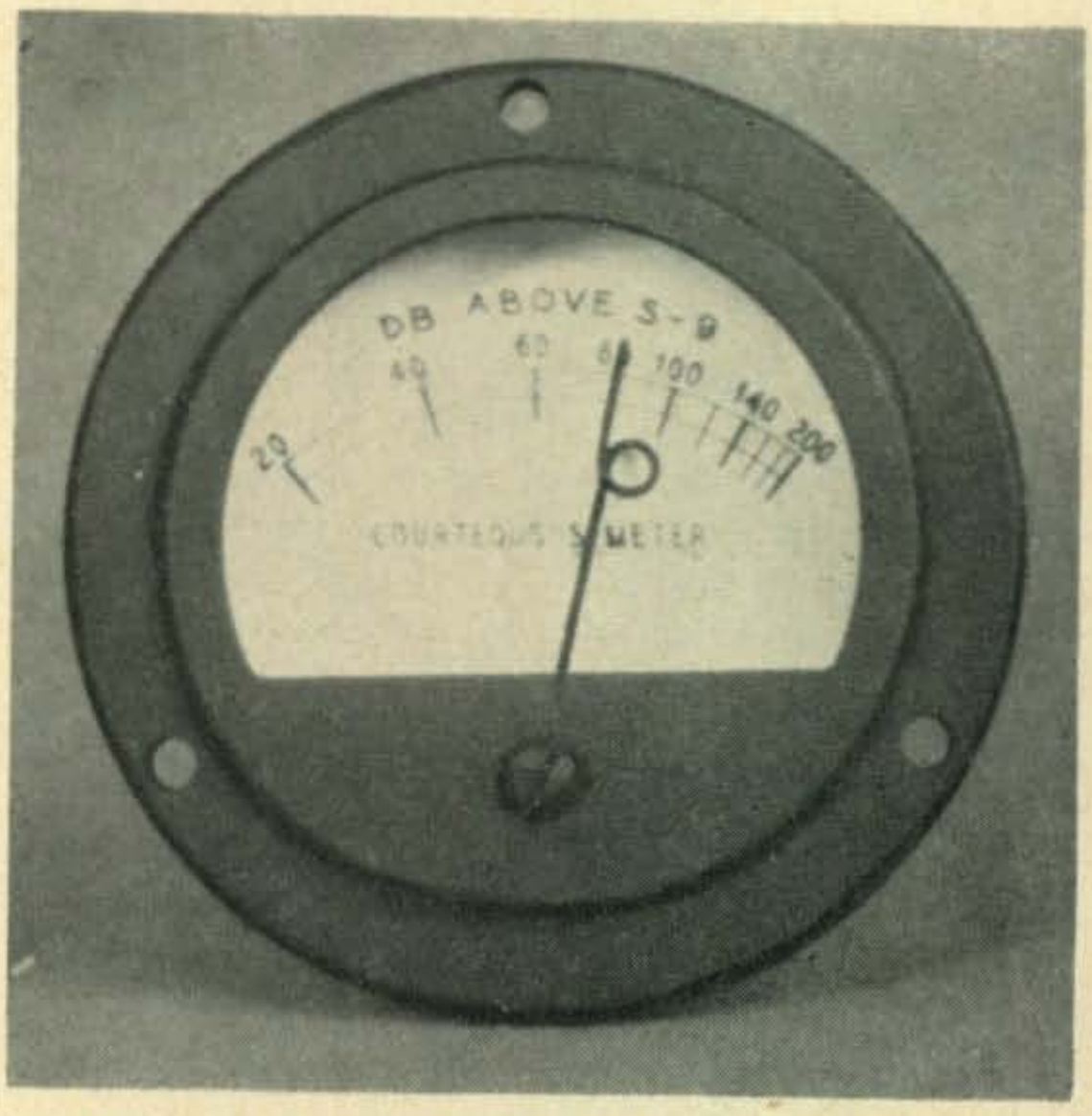
Obviously this meter should have higher range than a mere +60-db. And this particular gentleman-ham, who has never, *never* given anything less than "20-db over," could do very well without the range from zero to S-9.

Example 2. "Well, George, you're peaking about S-7 and I didn't miss a word. Gosh, I'm sorry I can't give you a real reading, but this darned receiver has an awfully 'scotch' S-meter . . ."

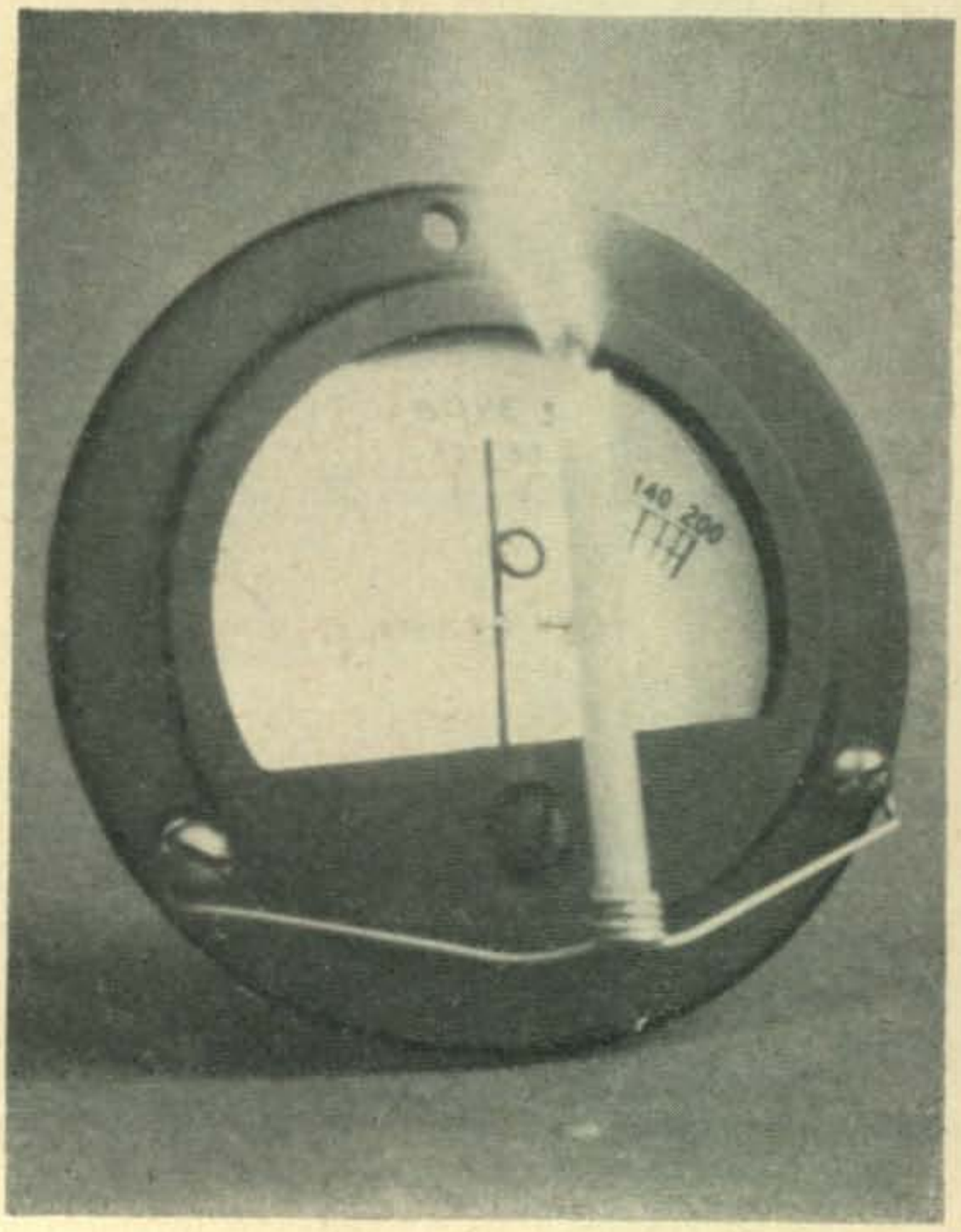
In spite of the apology, George was naturally so insulted when he heard the S-7 that he immediately went QRT and refused to QSL. Not only that, as soon as word got around about this guy's poor reports, nobody would talk to him at all. He is now weaving baskets at Happy Haven while mumbling, "CQ, CQ, cq, cq, . . ." *

But no longer does this need to happen. The Courteous S-Meter shown in Figure 1 is guaranteed to be politely prevaricative to everyone. The scale begins very sensibly at 20-db above S-9 and proceeds more-or-less logarithmically to +200-db. ** Note also that the pointer is permanently bent in a complete circle so that the operator may report this fact truthfully in each QSO.

The most important feature, however, is that the pointer is adjustable over its entire range from the front panel. This eliminates the need for any meter-movement within the case, and therefore, it is unnecessary to connect the Courteous S-Meter to the receiver circuits. ■



Above: courteous S-meter. Below: with illumination accessory kit installed and operating.



* I understand that the editor of this magazine mumbles the same thing in his sleep, but perhaps for different reasons.
** Plans call for higher ranges to be made available as progress demands.

a full-wave Folded Antenna for 20 Meters

Bob Perthel, W9MWD
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Wauwatosa 13, Wis.

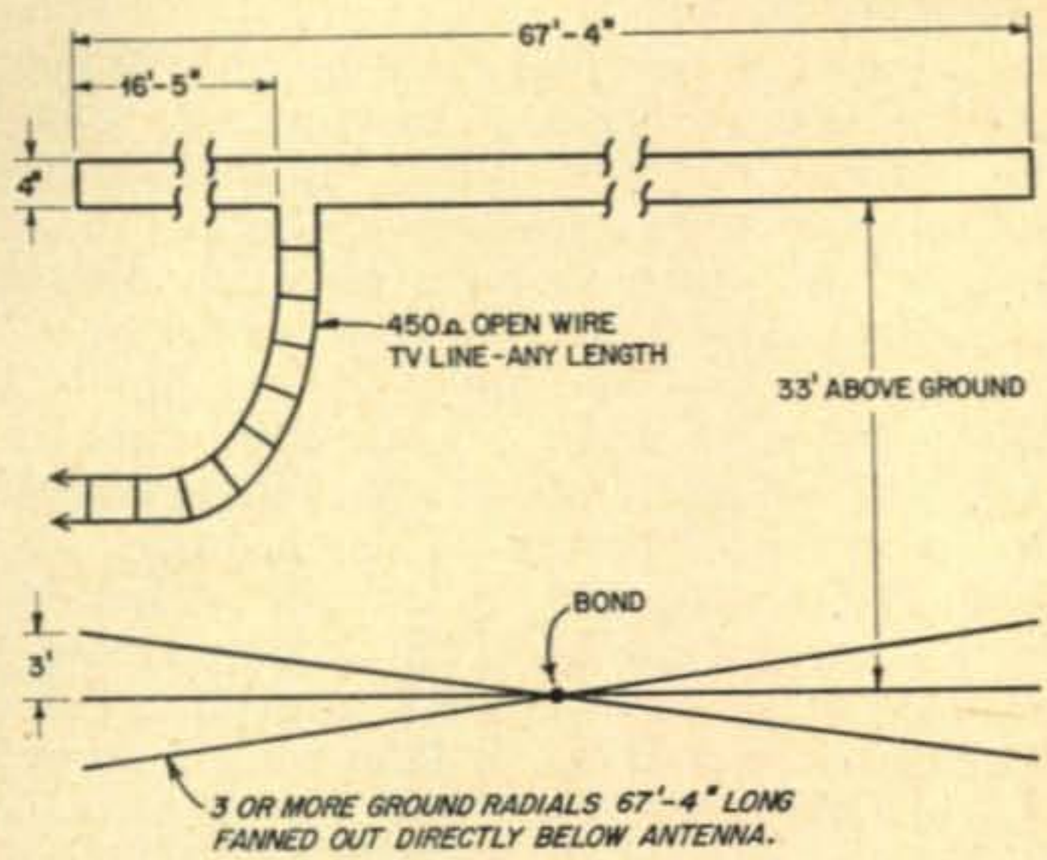
The popularity of the folded antenna has generally been limited to the dipole, however antennas of any resonant length can be folded and fed at a current point with flat line. Actually a folded full-wave has advantages over a dipole in that it has a slight gain and a clover leaf radiation pattern. Experience has shown the full-wave to be practically non-directional, in contrast to the decided nulls off the ends of a simple folded dipole.

A folded antenna is naturally a high efficiency system because of its broad resonance and high, easily matched impedance. A folded full-wave has an impedance of about 400 ohms at a current maximum, and 450 ohm open-wire TV line, presently available at less than 2 cents per foot, makes an excellent match. When it comes to efficiency open-wire line tops all others, and it performs nicely even in rainy weather.

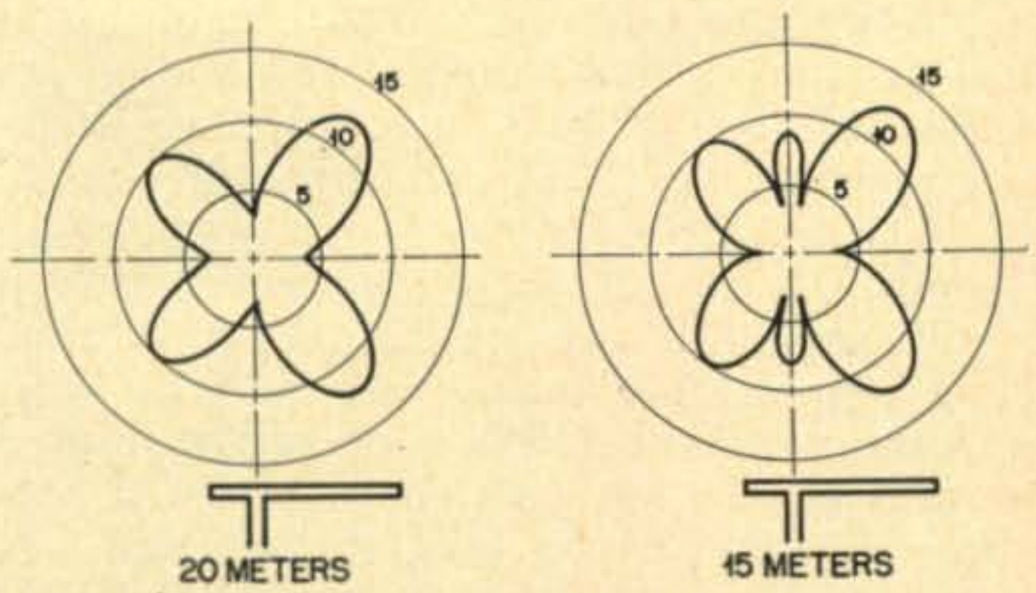
The antenna itself is made up of number 16 wire and 6 inch lengths of plastic tubing (the kind used by telephone companies to protect wires running thru trees, available from Greybar). The 6 inch lengths are drilled 1 inch from each end to give 4 inch spacing of the flat top. Insulation is not the big consideration at this point and wood or any other light weight material could be used. Weight being the big consideration as 24 spreaders (at 3 foot intervals) are needed to keep the wires spaced.

The ground system can be made up of any diameter wire, and buried an inch or so, just enough to get it out of the way.

The experts incorrectly assume that a ground system directly under a horizontal antenna will not improve the low angle radiation as the reenforcing of the direct wave with that of the image antenna occurs at considerable distance from the antenna. What has not been said however is that a ground system ½ wave below an antenna does cancel high angle radiation, and it does improve the efficiency of the system by minimizing dielectric losses that could occur as the result of the effective electrical ground being considerably below the actual surface of the ground. The cancelling of high angle radiation plus the increased efficiency does increase the power radiated at the lower angles. The



20 METER FOLDED FULL WAVE



ALTHOUGH INDIVIDUAL HORIZONTAL PATTERNS MAY VARY SOMEWHAT, THE ABOVE PATTERNS GIVE A GOOD IDEA OF WHAT TO EXPECT UNDER PRACTICAL CONDITIONS.

presence of the ground system also prevents nulls from occurring in the vertical pattern. No signal can be transmitted at vertical angles where a null exists. The space directly beneath the antenna should be clear of all obstructions to permit the ground system to work properly.

This antenna was tried at three different locations with exceptional results over a period of five years. On 20 meter fone all continents except Asia were worked with signal strengths of 9 or better. Stateside reports averaged well over 9 which is quite surprising for 80 watts input.

Although this is, strictly speaking, a 20 meter antenna and was designed as such, it will take power on 40 and 15 meters. The feeders do some radiating on these bands but it is entirely usable, and compares favorably with multi-band antennas. ■

Fishpole on 160

Harold E. Davis, W8MTI
Onondaga, Michigan

Living in an overpopulated housing project is not the best inducement to hamming. Several reasons may be given to back up this statement but the one of most importance here is the lack of space in which to hang up a suitable sky-wire. Being a 160 meter ham from the word go I looked around to find two good points between which to hang a half wave doublet. I couldn't find anything that even remotely looked like antenna supports. This brought about the horrible thought that I might be forced to operate on ten meters with accompanying tv-itis. Not being endowed with a surplus of energy when it comes to de-tv-eye-ing I went to CQ to see who else was having troubles. W2EUQ's article on a fishpole vertical for forty meters set up activity in the top story. If it works on one band it might work on another.

A fishpole was obtained that was nearly 25 feet long (actually two were obtained). Being as we had a large spool containing several thousand feet of #21 d.c.c. wire we used that instead of the #22 trolling wire used by W2EUQ. 275 feet of wire, just about twice the length of the formula ¼ wave, was used.

Getting the wire on the fishpole was the next step. Rather than wind the wire with the spacing wound at the ends we wound close wound at the top end and then used spacing through the middle and the bottom of the winding. This was to give more the effect of a top loaded vertical. In the interest of improvement let me suggest that you use 300 to 310 feet of wire for the low half of the band (1800-1900 kc) and 285 to 295 for the upper half of the band (1900-2000 kc).

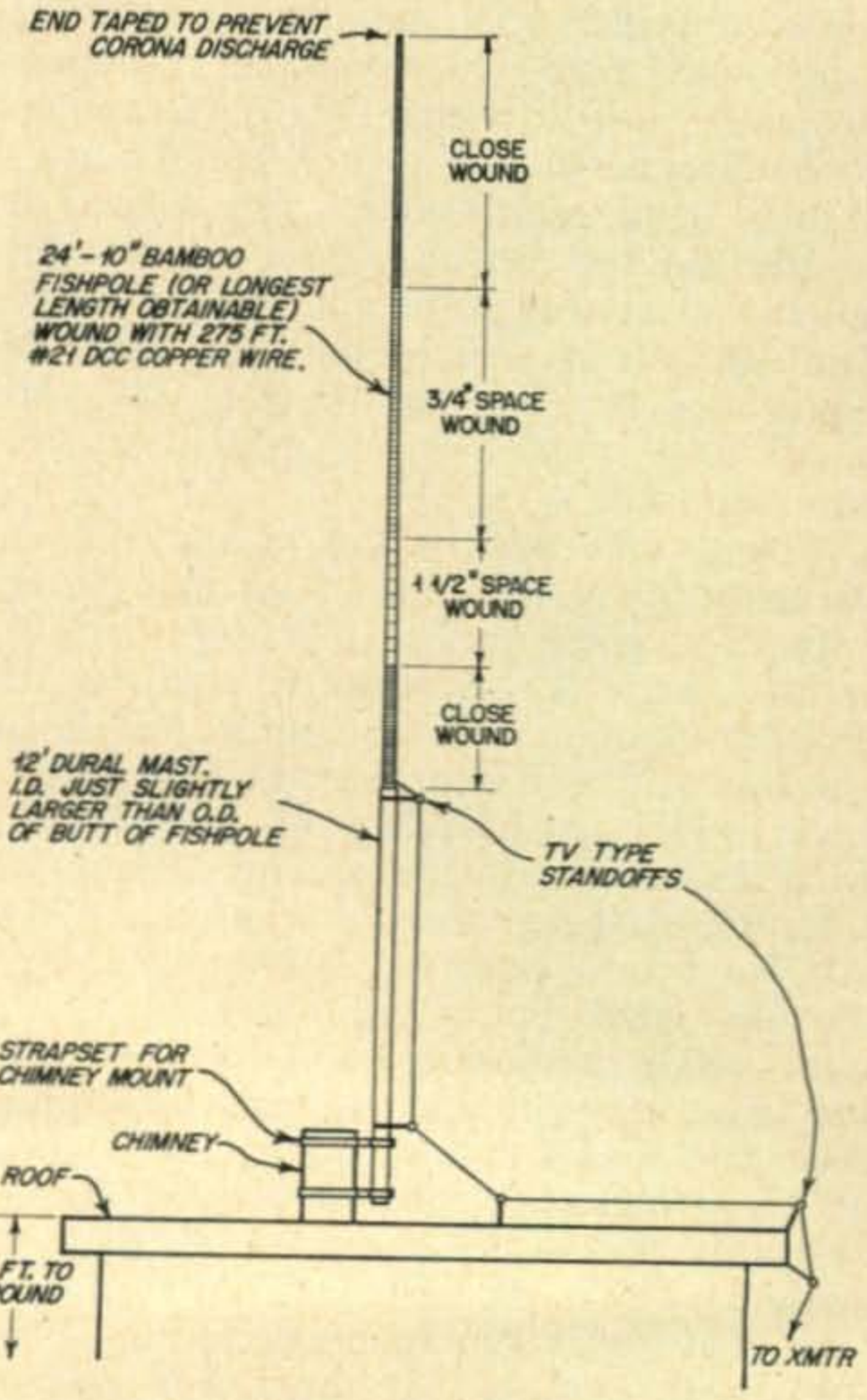
As I did it, a loop about one inch was made in the end of the wire and caught over the small end of the pole. This was then taped to prevent corona discharge. The first three sections of the bamboo were covered close and tight wound to give added strength and the next section was space wound with about ¼ inch spacing. The sections were then wound close for two sections and spaced for one. This worked out as planned. After getting about half the wire on the antenna the spacing was increased to about ¾ inch and continued to within three feet of the base of the fishpole. There it was close wound for a dozen turns and the end fed through a small hole just big enough for the wire. A knot was made in the wire to secure it at this point. About thirty feet of wire was left to serve as lead in.

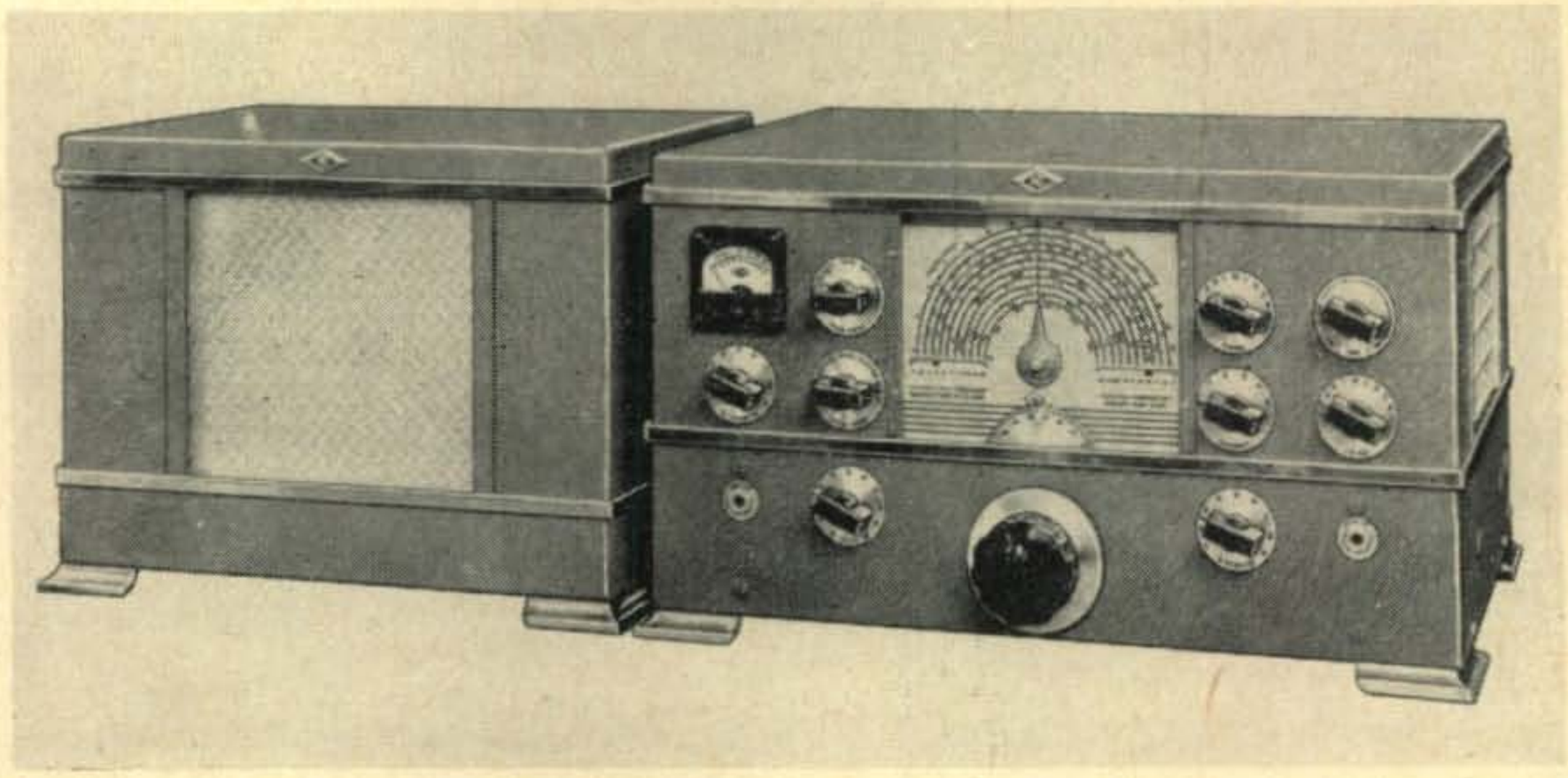
Mounting was accomplished by the use of TV chimney mounting straps spaced about two feet apart on the chimney. The lead-in end was then brought into the shack through standoff insulators.

The rig was then loaded up feeding directly from the link in the final tank into the antenna. The loading was identical to the ¼ wave horizontal that we had been using and the adjustment of the variable link in the final was sufficient for the whole band.

Total improvements went like this: I started getting out, I eliminated fundamental overload in nearby teevee sets that existed when using the horizontal, I had an antenna that withstood winds up to sixty miles per without guying, and to me, most important, something to talk about with most everyone and especially with W2EUQ who had wondered if the fishpole would work on 160 m.

One comment. Do the work outdoors where it is most practical. A bag or old newspaper tied in the end of the wire when it is laying out across the back yard and field is a great help in seeing where the end of the wire is. ■





New Life for the National NC-240D

William I. Orr, W6SAI

The National NC-240D was one of the most famous of the wartime receivers. A lot of them are still in use today in spite of the design being over fifteen years old. A great number of NC-240D's are reposing on the shelves of radio stores, taken in on trade for newer receivers. A used NC-240D in good condition is an excellent "buy."

Since the basic design of the NC-240D is still up-to-date, the owners of these receivers can take advantage of some of the newer tubes to modify the receiver for 1957 performance. Here's how to do it.

The NC-240D was designed before much thought was given to such interesting terms as *noise figure*, and *signal-to-noise ratio*. Even so, a lot of DX can be heard with these fine sets. A few months ago W6SAI wandered into the local radio store and found a second-hand NC-240D sitting on the shelf. It looked in good condition. He paused and tweaked the dial. As if by magic one of the salesmen materialized at his side. "Are you interested in this good used receiver, Sir?" he asked.

"Oh, no," replied W6SAI. "No interest at all. I couldn't possibly use a second receiver, thanks just the same."

Waiting until it was dark enough to spirit the NC-240D in the house without the XYL becoming suspicious, W6SAI immediately rushed the receiver to the workshop. After a few evenings' work, he stepped back to admire his handiwork.

* * *

The up-dating of the NC-240D entails replacing the r-f amplifier tube and the converter tube with more modern, less noisy tubes. The original "front end" of the NC-240D is shown in *fig. 1*. A 6SK7 rf amplifier is used, followed by a 6K8 detector. The equivalent noise resistance of the 6SK7 is 11,000 and the equivalent noise resistance of the 6K8 is 290,000. The smaller the noise resistance figure, the better the signal to noise ratio of the set. Noise resistance figures greater than about 3500 are frowned upon for use in rf amplifiers working below 30 mc. The "partition noise" of the mixer tube usually runs about twenty to thirty times that of a good rf amplifier. Even so, it can be seen that there is plenty of room for improvement in the "front end" of the NC-240D. This hard, cold fact is verified when the receiver is used for DX work on the 10 meter band. It just "doesn't have it." The weak signals are buried under an avalanche of set noise.

The RF Changes

To reduce the headaches to a minimum, it would be nice to replace the rf amplifier tube with another tube having the same pin connections. Luck is with us, for the 6SG7 will fill the bill. The noise resistance of this pentode is about 3100, or about 1/3 that of the 6SK7. The pin connections are the same, and the tube was designed for service in the 30-50 mc region. We are not so lucky with the mixer tube. There is no modern equivalent of the 6K8. The temptation to use the 6SB7-Y converter tube was too strong, so the 6K8 stage must be rewired accordingly. The 6SB7-Y

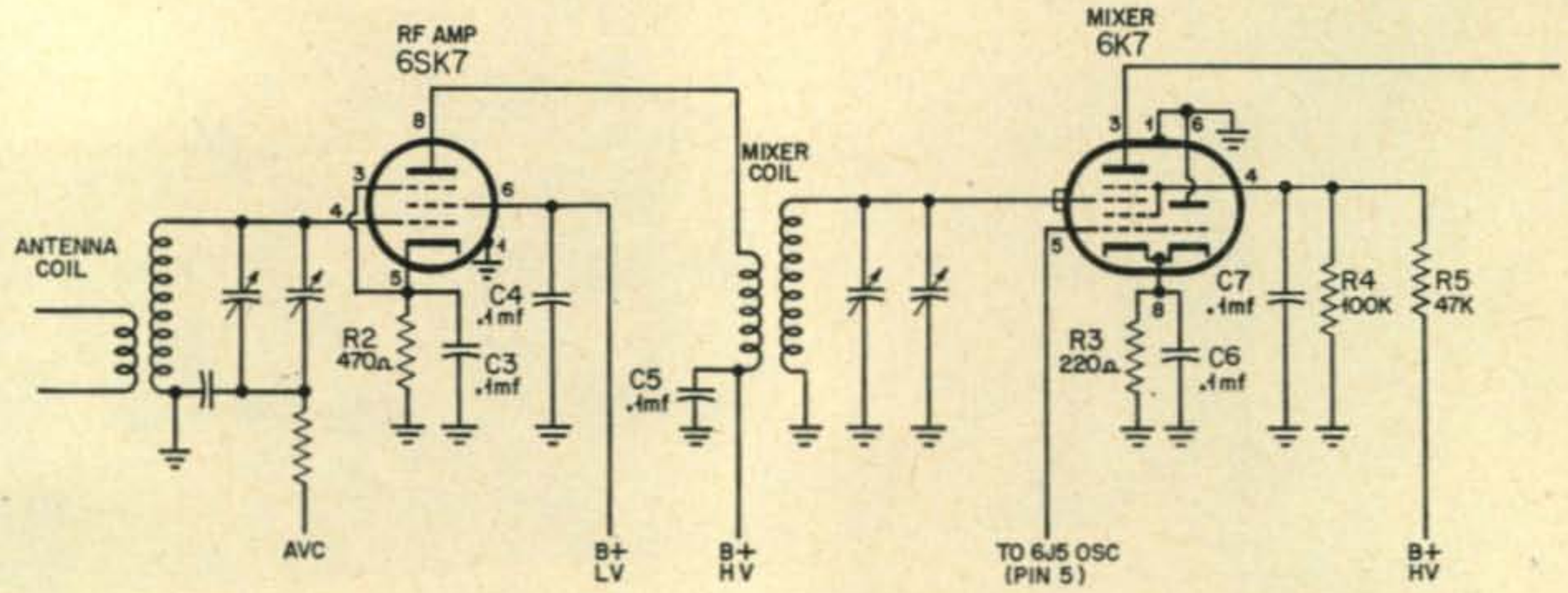


Fig 1

noise resistance is only 62,000, or about ¼ that of the 6K8. Preceded by the 6SG7, the noise resistance figure of the 6SB7-Y is low enough not to be a limiting factor in absolute receiver sensitivity.

Reworking the Receiver

The first step is to up-end the receiver and examine the 0.1 mfd paper bypass capacitors scattered about beneath the chassis. These are probably over ten years old, and chances are that most of them are leaky. Go to the radio store and buy a bagful of 0.1 mfd, 400 volt capacitors and replace all of the units in the "front end" (left section) of the receiver. You will save yourself a lot of headaches if you do this "right off the bat." If you feel rich, by all means replace all the other paper bypass capacitors in the receiver. It is money well spent.

The first thing to tackle after you are satisfied that the receiver is working correctly is the rf amplifier modifications. The cathode resistor R2 (470 ohms) is replaced with a 100 ohm, ½-watt resistor. Pin 3 of the socket is bypassed to ground with a .01 mfd ceramic capacitor. The B-plus lead to the screen (pin 6) of the socket is cut off and removed. It is necessary to raise the screen voltage on the 6SG7 from the original value of about 60 volts to almost 125 volts. A nearby point of B-plus voltage is the "hot" terminal of C5, the 0.1 mfd bypass capacitor for the plate circuit of the rf amplifier coil assembly. C5 lies parallel to the terminal block of the coil catacomb, between it and the 6K8 socket. The B-plus wire running to C5 is white, with a red tracer. Place a 10,000 ohm, 1-watt resistor between the C5 tie-point and pin 6 of the 6SG7 socket. Finally, plug a 6SG7 tube in the socket in the place of the 6SK7. Turn on the receiver and listen across the bands. You should immediately notice that the receiver is "hotter" even before you align the rf stage. Before you attempt alignment, however, let's replace the 6K8 mixer tube.

Mixer Changes

Remove the cathode resistor R3 (220 ohms, ½-watt), the cathode bypass capacitor (0.1 mfd), the two screen resistors R4 (100,000 ohm, ½-watt) and R5 (47,000 ohm, ½-watt). Also disconnect the screen bypass capacitor C7 (0.1 mfd). Disconnect the grid cap from the grid lead atop the chassis. At this point of the game, you have left pin 1 grounded, the filament leads connected to pin 2 and pin 7, and the plate lead from the first i-f transformer connected to pin 3. Now we're ready to start putting things back together.

First of all, pass the grid lead down through a hole in the coil terminal block. The grid of the 6SB7-Y is at the base, and we must get the grid lead below the chassis. There is a convenient hole below the tuning capacitor, and you can push the grid lead through this hole. Dress it towards the mixer socket and solder it to pin 8. The cathode bypass capacitor (C6) is installed between pin 6 of the socket and ground. Across this capacitor is placed a 76 ohm, ½-watt resistor. A 24,000 ohm, 1-watt resistor is soldered between pin 5 and pin 6 of the socket. Reconnect the screen bypass capacitor (C7) to pin 4 of the mixer socket, and install the new screen dropping resistor (8200 ohm, 2-watt) between pin 4 and the B-plus tie-point that originally supported R5.

The last job to do is to install a 250 mmfd mica capacitor between pin 5 of the mixer socket and pin 5 of the 615 oscillator socket. Slide lengths of insulating spaghetti over the wire leads of the capacitor and connect it between the tube socket pins. Press it down against the sockets so that it will not interfere with the movement of the coil catacomb.

This completes the modification. Plug a 6SB7-Y in the mixer socket and turn on the receiver. If you have a high resistance voltmeter you should check the cathode voltage of the tubes. It should be about 1.4 volts to ground on each socket. The screen voltage at each socket should be about 100 volts or so.

The last step is to align the receiver according to the instruction manual. Sensitivity should be better than 0.5 microvolt on all bands, and there should be very little set noise when the receiver is run with no antenna. Be sure to make the final alignment of the rf

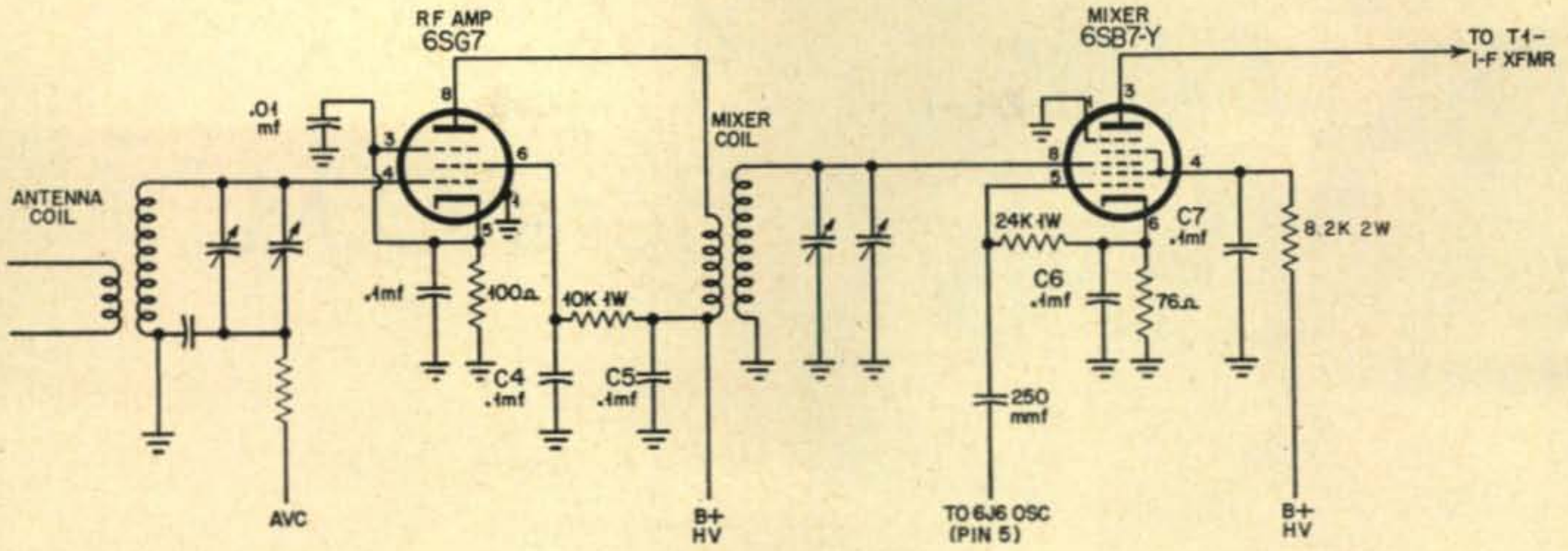


Fig 2

amplifier grid circuit after the antenna has been connected to the receiver.

If it is desired to raise the if gain of the receiver, it is only necessary to shunt the 22,000 ohm, 2-watt voltage dropping resistor (R-37) with another resistor. R-37 is located between two phenolic tie-point strips in the lower right hand corner of the receiver, near the phone jack. The value of the shunting resistor can be best determined by a trial and error process. Too high a value of screen voltage will result in instability in the i-f amplifier.

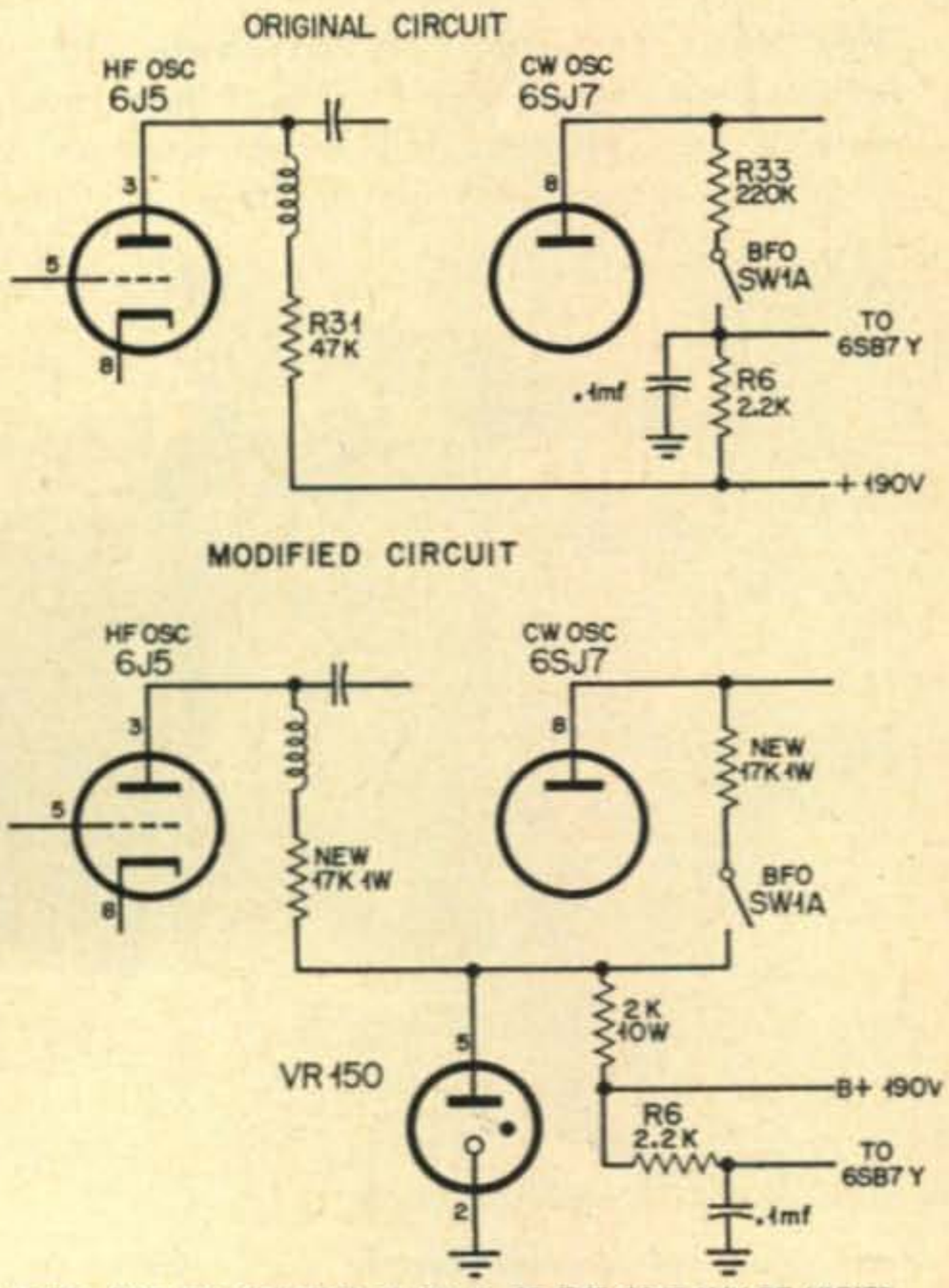
As-is, the NC-240D is not bad when it comes to SSB operation. Things were progressing swimmingly, when it was noticed that the SSB signal being received would occassionally take a nasty "yoop," then return to zero-beat. This was confusing, to say the least. After a bit of detective work, the "yoop" was found to be caused by a drop in line voltage whenever the XYL turned on the electric stove. A line voltage drop of 3 or 4 volts really "queered the works" as far as SSB reception was caused. A simple solution was to voltage regulate the high frequency oscillator and the b-f-o, as shown in the illustration. Dropping resistors R31, and R33 were removed, and a VR-150 tube was installed on the chassis between the 6SG7 r-f amplifier tube and the antenna terminals. The socket was mounted about ½-inch above the chassis on two metal pillars, and the leads passed through a ½-inch rubber grommet mounted beneath the socket in the chassis.

The VR-150 cleaned up the voltage sensitivity of the receiver and also increased the B-plus voltage on the b-f-o, which gave a higher injection level, more suitable for SSB reception.

Everything worked fine for a day or so, when it was noticed that a strong thump on the operating table would detune the receiver, particularly on the 28 mc band. Probing around the coil catacomb produced no suspicious components, or loose connections. It was finally determined that the coil catacomb was a little loose on the supporting rails, and the strong thump jiggled the contacts just enough to produce a frequency shift in the high frequency oscillator. The retaining screws on the two rear catacomb supports were tightened, reducing the frequency shift by a fair amount. A complete solution was achieved when the finger connectors of the coil catacomb were liberally soaked with a "TV" contact cleaner. A small brush was dipped in the solution, and the contacts were scrubbed gently. *DON'T* try and remove the coil catacomb in order to make the cleaning job easier! The author tried it, and spent four or five hours getting it back in the receiver. It's a nasty job —sort of like putting catsup back in the bottle. You can do it, but it isn't easy. Take my advice and clean the contacts with the

[*Continued on page 164*]

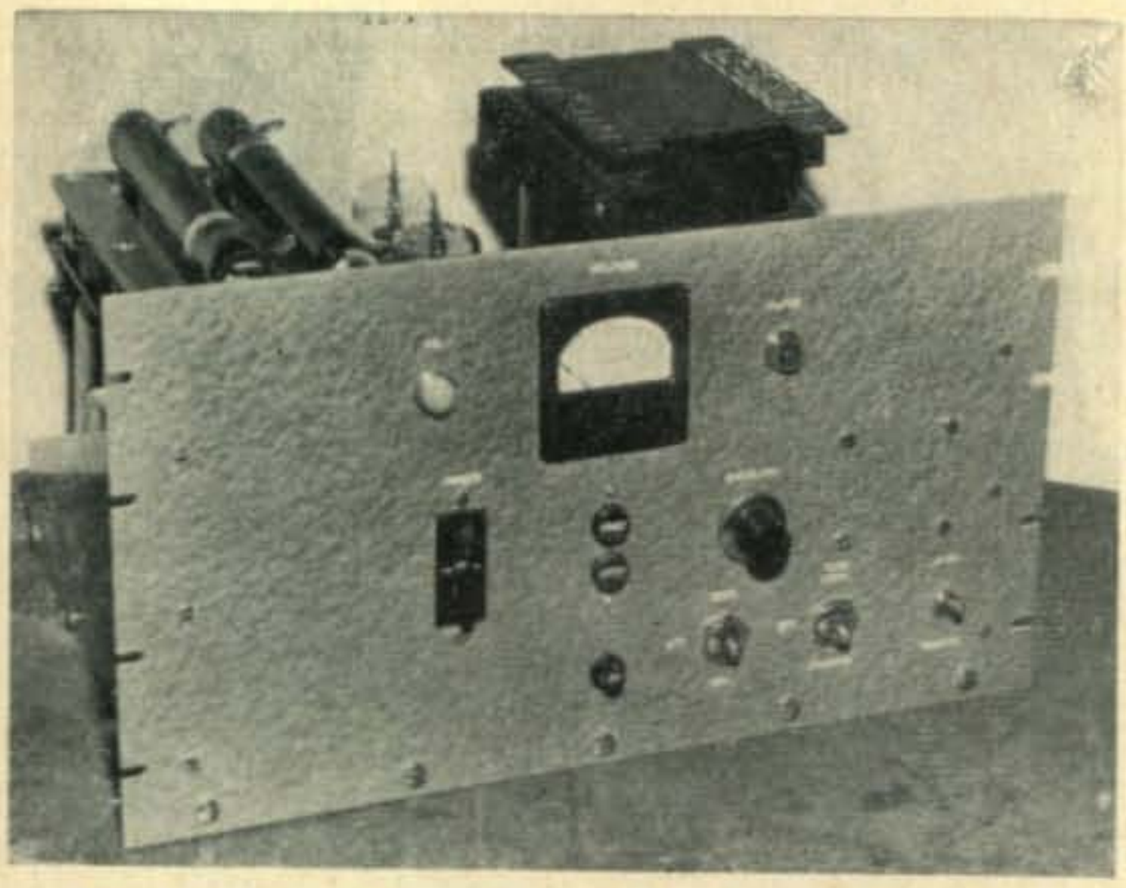
Voltage regulation of the NC-240D for better SSB operation



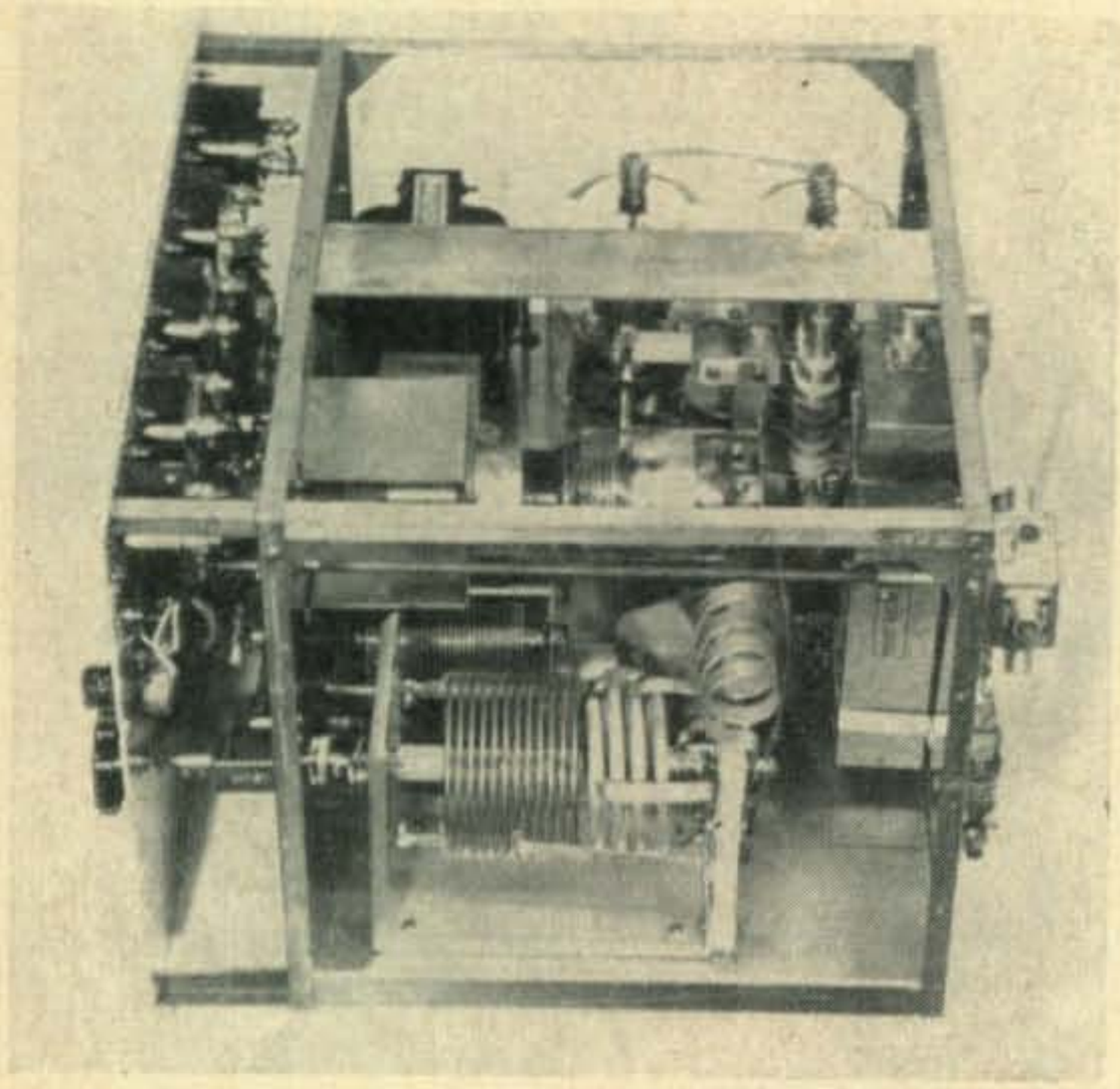
NOTE – THE 47K RESISTOR TO PIN 8 OF THE 6SJ7 MAY BE VARIED IN VALUE TO RAISE OR LOWER THE LEVEL OF BFO INJECTION.

4-400A's Here O.M.

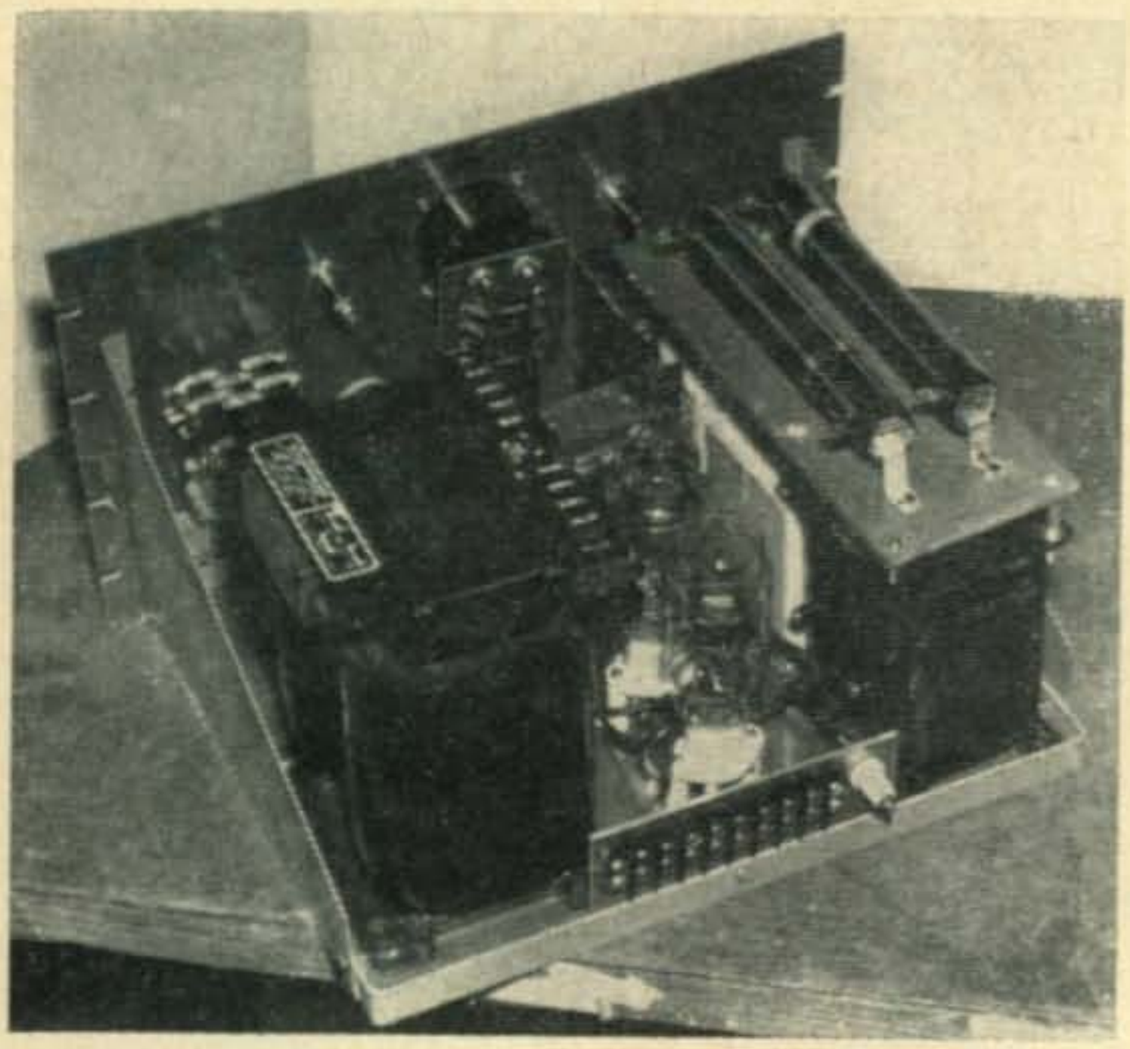
Irwin R. Wolfe, W6HHN
Eitel-McCullough, Inc.
San Bruno, California



Front view of power supply for 4-400A final amplifier.



Side view showing B&W bandswitching coil mounted on the 10¾ by 14¼ by 1 inch chassis. Note ¼ inch phenolic rod which operates the coax antenna selector



Rear view of power supply for 4-400A final amplifier.

Recently, Eitel-McCullough sponsored a contest for all their ham employees. The contest was for an original or unusual design of any electronic device. The contest winners would build this equipment and keep it, and the company would pick up the tab for cost of all the parts.

It just happened that I had been (day) dreaming of the ultra-deluxe power amplifier I would build if some mythical relation would remember me in passing to the extent of a few thousand American dollars. This job would have everything in it but the kitchen sink (no water cooling). It would handle a full gallon without twitching its anodes. It would have . . . but suddenly, the contest was announced and those dreams could be put down on paper. I went to work with a will, a couple of handbooks, back issues of CQ, QST, a Radio Masters and an over-stressed imagination. I was going to copy every worthwhile idea and wind up with the best of the best. In due time I came up with a set of sketches and a circuit diagram and, with all the crossed fingers I could manage, submitted my entry. After a few weeks of nail biting, sleepless nights and fervent hoping, the contest winners were announced, and lo, mine was among those whom the Lord had blest.

I need not go into the virtues of the tubes chosen for this job, two 4-400A's. Anyone who has worked with them knows they can take anything you can put into them but too much or too little filament voltage. (A powerstat and filament voltmeter are included in this job.) My evenings and weekends were well spoken for, to the distress of the other members of my family, but came the day when "IT" was done and put ON THE AIR. It does my heart good to see that electric meter spin when I hit the key and to tell some DX station I'm running a KOOL KILOWATT input and my power out meter indicates 723 watts into beam number three . . . come to think of it, that's the only beam I have. Now for a description of the contest winning rig.

The circuit is straightforward, (see diagram). The grid circuit is tuned and uses the turret type of switching. The output circuit uses a pi network with a bandswitching heavy

duty coil, which is mechanically coupled to the rigid turret, eliminating a control. The bands covered are from 10 to 80 meters. Panel switches provide selection for operation of the amplfier as a linear, for CW, or as an amplitude moduated amplifier. The power output is continuously monitored and the VSWR can be instantly checked.

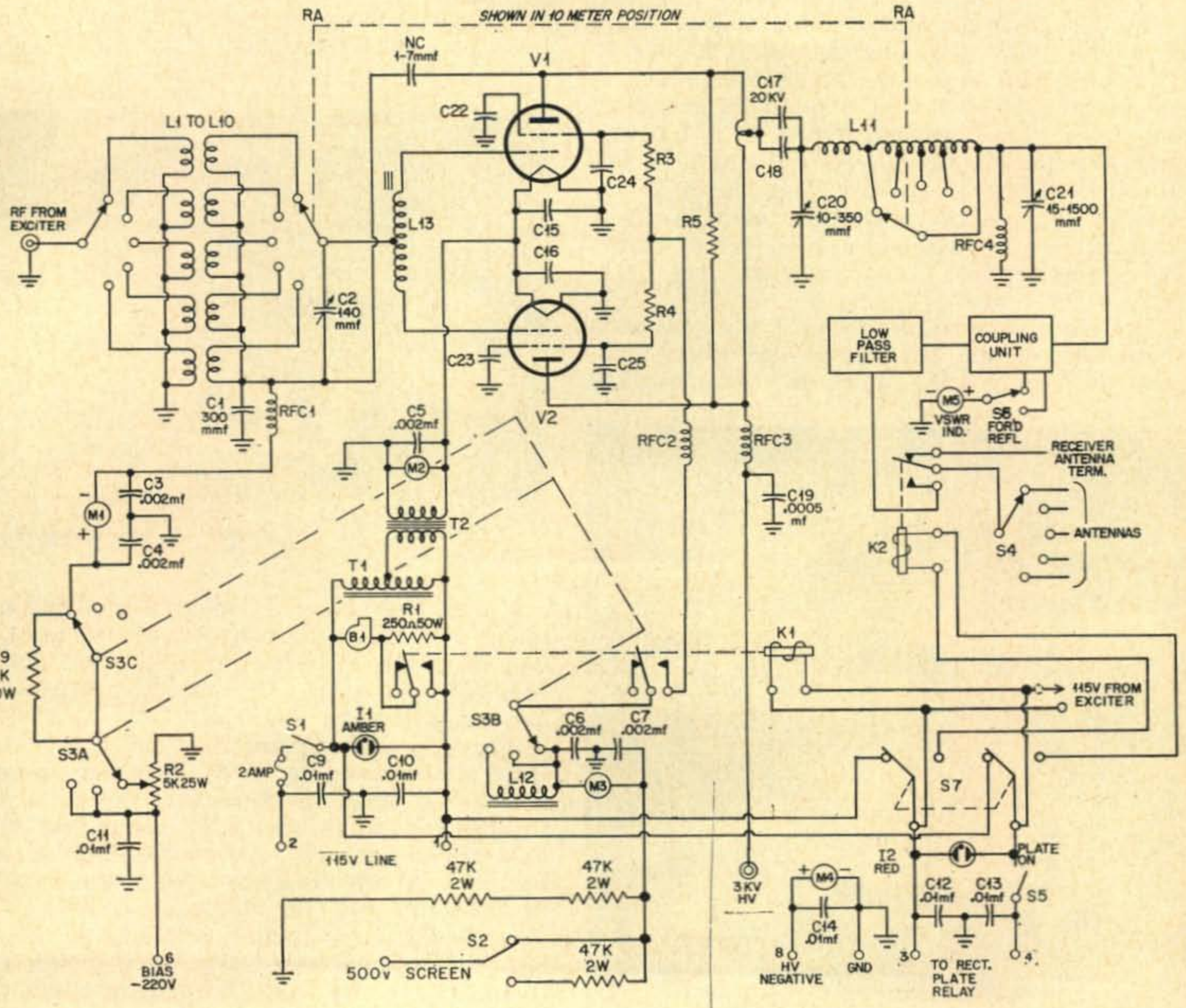
A variable vacuum capacitor in the input of the pit network provides sufficient range for the lowest frequency, and its 10,000 volt rating will forever eliminate any flashover troubles. The loading capacitor has sufficient range for the lowest frequency at an output impedance of either 52 or 75 ohms. The output of the pi section connects to a micromatch coupling unit, for output power and VSWR measurements. A low pass filter precedes the connection to the co-ax receive-transmit relay and the antenna selector switch. The rf wiring from the tubes to the vacuum capacitor and bandswitch coil uses 5/8" silver plated copper ribbon. The panel switch alongside the antenna selector switches from incident to reflected voltage for VSWR checking. The adjacent control is used to set the power level of the output meter and requires initial calibration.

The meter at the extreme left of the panel measures the filament voltage at the tube terminals, and the filament control knob adjusts the primary voltage of the filament transformer. To the left of this control is the transmission selector switch marked LINEAR, CW and AM. In the linear position, the grid bias becomes adjustable from the bias control so that the desired plate resting current can be set. In the CW position, normal bias is applied to the grid and the bias control becomes ineffective. In the AM position, a reactor is connected into the screen circuit enabling the screen to self-modulate in phase with the modulated plate. The switch marked TUNE-OPERATE, places a high resistance in the screen circuit in tune position reducing the screen current (and voltage) to a low value, thus eliminating the danger of excessive plate and screen currents during the tune-up periods.

The other meters are for GRID current, SCREEN current and PLATE current. The

[*Continued on page 148*]

Schematic of 4-400 KW amplifier
Parts list on page 148



the calm KILOWATT

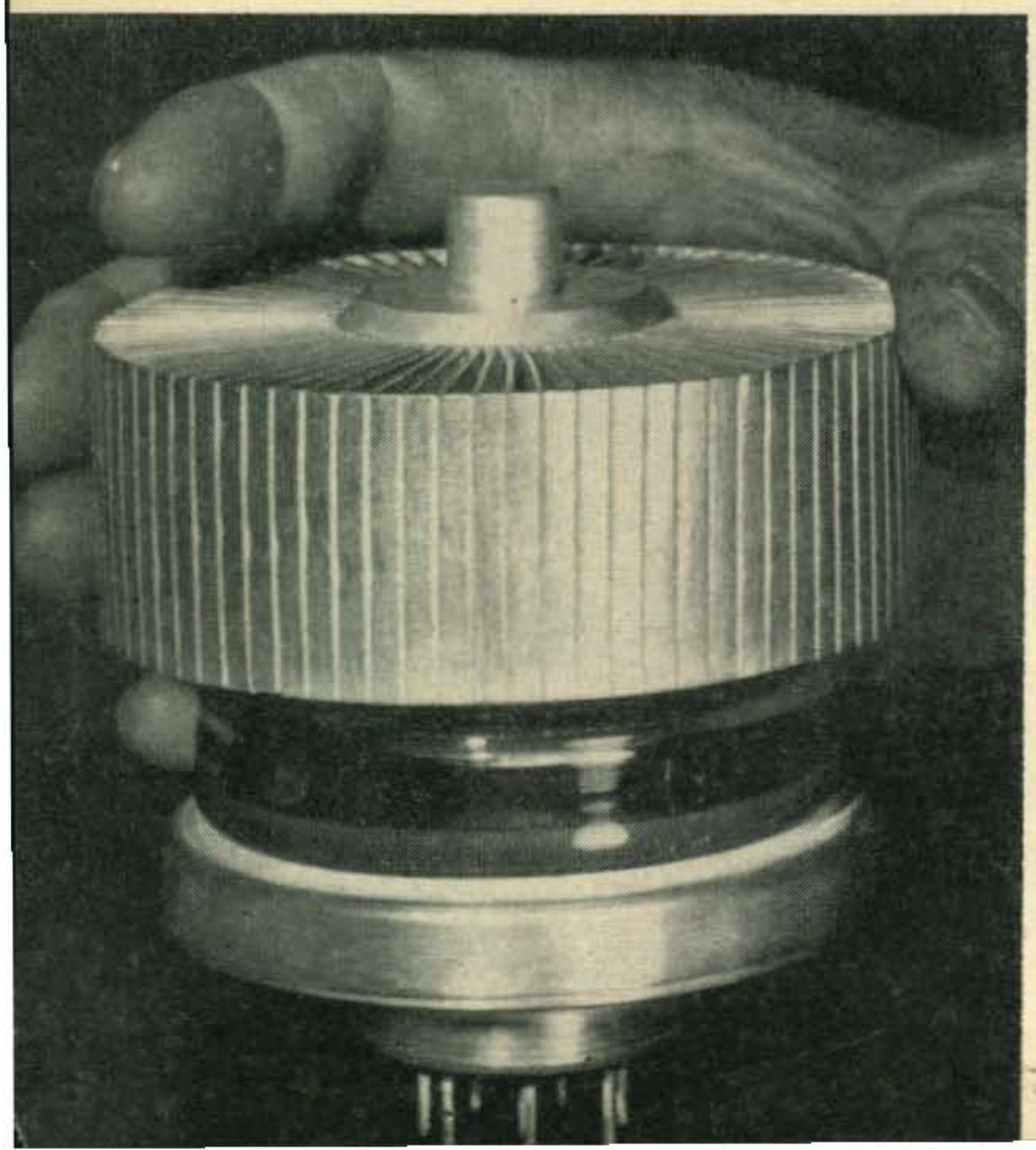
David H. Atkins, W6VX
542 S. Irving Blvd.
Los Angeles 5 California

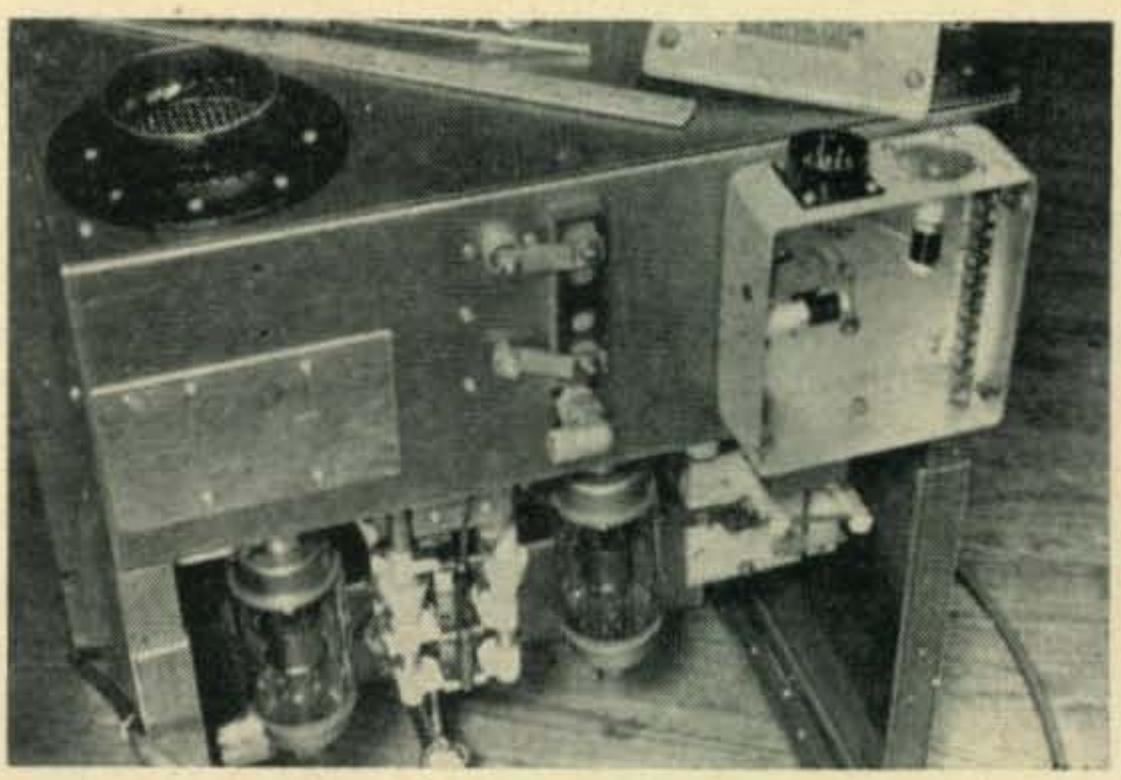
If you are looking for some power along with stability and linearity in a power-amplifier, here is a way to get these features simply and in a small package if you wish! The following illustrates the application of one of Penta Lab's recent PL-172 tubes to a multiband "final."

The 172, a pentode incorporating unusual if not never-before-obtained design principles, is a very compact tube with a plate-dissipation rating of one-KW. As the dissipation indicates, it does the job that FOUR of the 4X250 type do, and with attendant simplification of circuit, both electrically and mechanically. The feed-through capacitance is exceptionally low, permitting a high stage-gain with stability, which is another way of saying that, with good grid-to-plate-circuit shielding, the rig will not take-off on several unwanted frequencies and burst into flame! Don't get me wrong. I am not saying you should unplug your present tube and throw it away. I do say that the 172 sits quietly in the socket, and puts out with the rf expected of it—without a fuss. (Note battle-scars on the plate choke from previous bouts with other tubes.)

In the first photo, the tube may be seen lying out of the socket, on the plate band-switch. A good idea of its small size may be had from nearby components. The base-pins, two of which are visible near the "hot" end of the plate-choke, are seven in number. These plug into a standard 829 / 832 type socket. To realize low inductance in the leads between circuit and the actual elements within, multiple pins are used. Two are for the control-grid, and the connections on the socket may be identified as those to which are connected 20 ohm, ½ watt carbon resistors. Note that these are wired with a minimum lead-length on the socket end. The other ends join, and go to the grid-tank band-switch. (The plate circuit uses a "Globar" 10 ohm resistor-coil combination. The coil of #12 wire, 4 turns, ⅝" long X ⅝" O.D., is wound alongside the resistor.)

Those of you with the analytical approach might ask how-come in the paragraph before last it states the tube works "without a fuss," then goes on to say that suppressor resistors



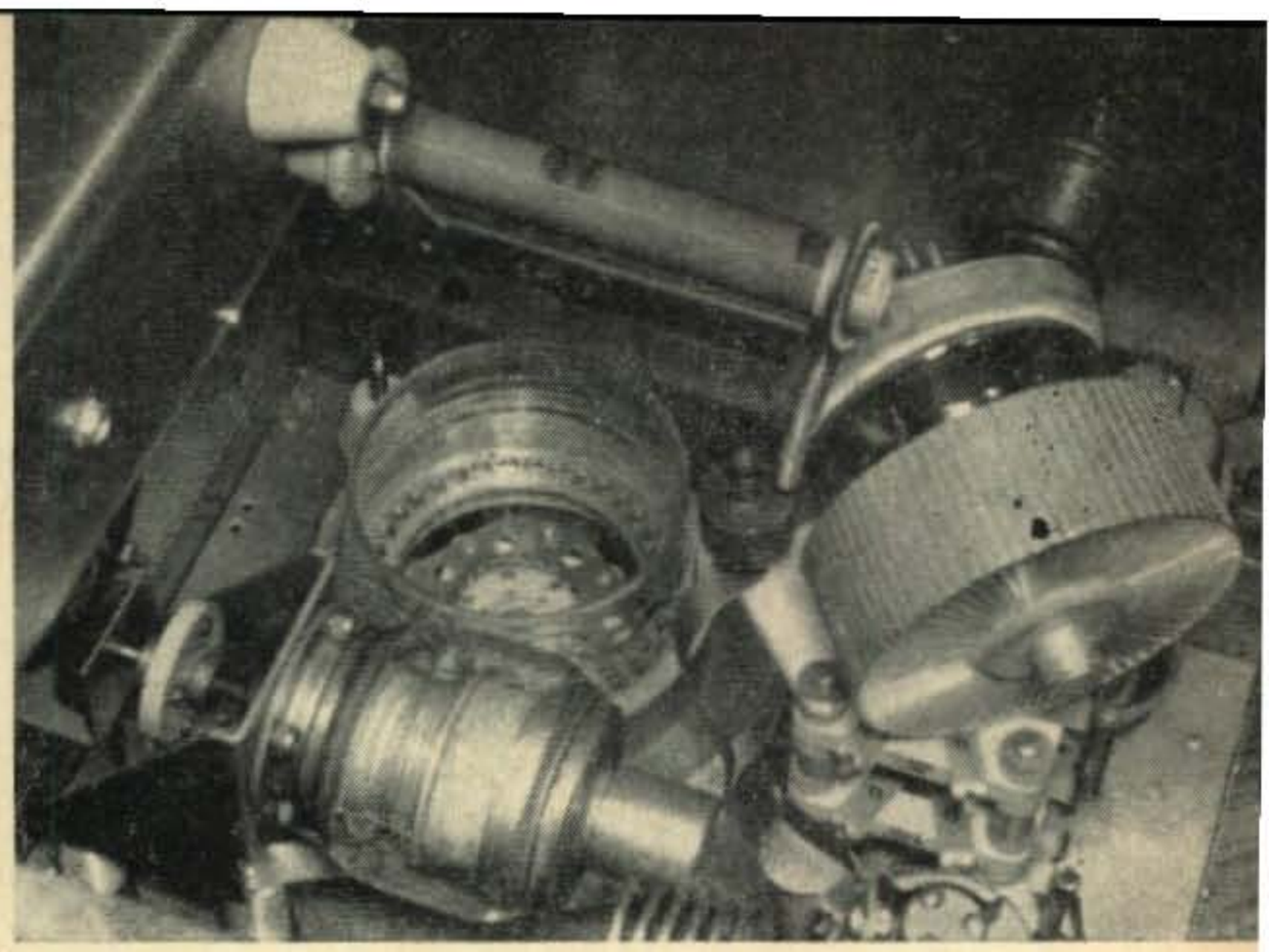


"Showing the air intake at upper left."

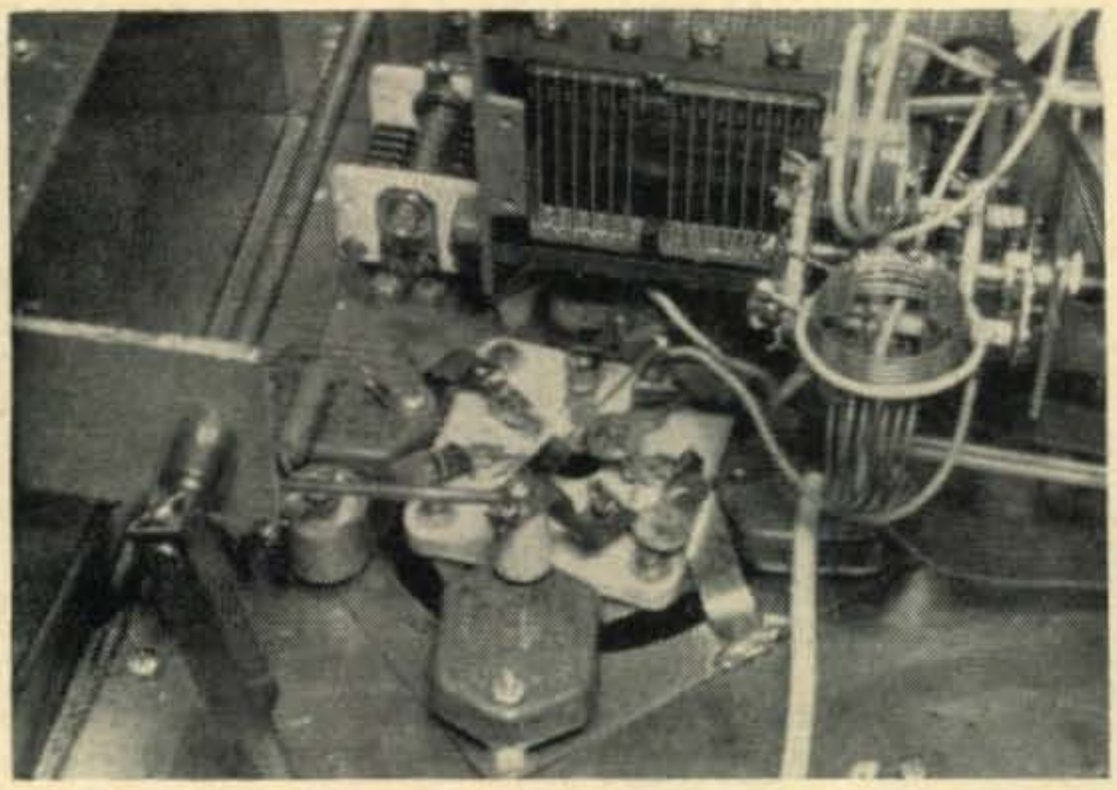
are used. One answer is that there is NO tube made with zero inter-electrode capacitance, of course, so this precaution has become standard procedure in high gain amplifiers, mainly to discourage vhf oscillations.

The tube uses an indirectly-heated cathode with a heater rating of 6.0 volts at approximately 7.5 amps. Two more of the pins carry this power, while the three remaining serve as a low-inductance path for the cathode connections. At the time the socket was changed to take the PL-172, no factory-built socket was available to make connections to the screen and suppressor grids. It was necessary to make a collet to fit the screen ring. This screen-grid connector is made from .025-inch

beryllium-copper sheet and may be seen fastened to the top-side of the ceramic socket. Visible in the photo showing the tube alone is a concentric ring, or cylinder, the screen terminal, located between the base pins and the suppressor connection (to be seen next to the glass separating the anode from the suppressor). The bottom view shows the bottom of the collet plate which is supported at chassis level by four 1200-volt, mica bypass capacitors. The gap between the screen-collet plate and the chassis provides a passage for the air from the blower which cools the lower parts of the tube before passing upward and



"Note battle scars."



The 7 pin ceramic socket is supported by mica bypass condensers allowing air to pass between the screen collet and ground.

through the ring of holes and on through the cooling-fins of the anode, in the usual manner. The holes are drilled in an aluminum ring on a radius slightly greater than that of the suppressor connection. The air is guided through the cooler by the insulating cylinder shown in the above-deck view. The tube is mainly supported by the suppressor ring. Here three spring-fingers hold the 172 down in its socket assembly, and serve also to maintain a good electrical and thermal connection at chassis potential. In this particular application the suppressor is operated at ground potential. It is pointed out in the manufacturer's data-sheet that by running a voltage in the order of plus 50-volts on the third grid the overall efficiency may be increased approximately 10%. However, since ample power is obtainable without using this feature, and further circuit simplification results (no added bypassing etc.), a ground is used in this case. Either way, don't let that extra grid scare you. It helps in transmitters as much as it does in receivers.

The rf drive used here comes from a 6146 in the output stage of an exciter, which uses an MBL-40 multi-band tank for convenience rather than for efficiency. The power out of this exciter will just about light a 25 watt lamp to normal brilliancy under optimum coupling conditions. An idea of the driving power required for the final stage may be had from the fact that the output link on the MBL is never required to be near maximum coupling. The drive requirements may be exceeded on any band. A length of coax brings rf to the chassis at the "final," where the drive is made "push-pull" in the "172" grid circuits used for the various bands. Half the rf voltage feeds the grid, and the out-of-phase voltage on the other side is used to provide neutralization via a balancing padder capacitor (adjustable to balance the voltage to ground). It then goes directly up through the chassis terminating in a short brass stud, atop a stand-off cone, which is visible in the upper corner of the plate compartment near the socket. The padder is adjustable from the front panel (via a small hole) and is shown in the bottom-view photo as a variable with ceramic endplates. This method is one of many to be seen in the various handbooks. Actually, the PL-172 is well enough shielded internally so that it will not "take off" without neutralization but the neutralization is almost a necessity in a linear amplifier to prevent even a small amount of regenerative feedback, which can cause nonlinearity and distortion.

Air is carried into the lower (grid) compartment of the chassis via a length of 4-inch dia. flexible air-duct type automotive hose. This way of doing it was used to give quiet blower conditions in the room with the rig turned "on." The squirrel-cage type blower is normally off unless the set is on-the-air, as the tube's heater-power is not high enough to cause overheating of the tube during standby. The blower is mounted on shock-mounts to minimize its noise output. The flange shown on the bottom of the chassis is constructed from two parts of common food-cans. The disc part is a coffee-can lid, while the cylindrical piece is a section of another can which was chosen to fit the inside diameter of the hose. A similar arrangement is used on the flange of the blower housing to complete the air connection.

Since the PL-172 has a very high order of conductance, a low plate-voltage may be used compared to tubes of anywhere near its power-

[*Continued on page 175*]

How To Raise Chipmunks In A Wet Climate

Kenneth E. Lohner, W6GTG
5400 Rockwell Road
North Highlands, Calif.

Gather around you envious characters and I'll tell you how I won the prize in the 1956 Sweepstakes. I assume it's First Prize . . . it's got some fancy lettering on it that by turning upside-down and using a mirror looks like "Hobby" so I guess that is what it is.

To go back a ways, I should tell you about pre-contest preparations. I heard some brain on 10-meters say contests are won or lost before they start. I can tell you right now I'd have lost if I'd been prepared. A guy gets into a state of nervous exhaustion thinking beforehand about contests and dentist offices. Luckily I'd forgotten all about the contest and while waiting for the Little Lady to iron a shirt for me I happened to turn on the receiver. All at once the band errupted into "CQ Contest" and no one listening for an answer. This included me. But the weak-lunged guys soon ran out of wind and by sheer exhaustion had to stop calling. Then is the time to slip in a brief call and settle back and hear 15 stations call you. Talk about a thrill! The only time I ever had that happen before was when I tried my phone patch by dialing for the time. This is accepted procedure. Don't try it on top of some net!

The first one to call me was a W3. Out here where the West begins the W3s usually give me some report like "3 by 5 when there was no one on top of you." Wow! Q5 S9 in Maryland! I didn't want to break the man's heart so I had to give him the same. One would think conditions must be ideal during contests because my log shows it. They were perfectly stinko out here but golly what's a Joe to do?

In order to get attention I had to convince the contesteers I was in a rare section. By putting on the tail end of my calls the startling information that I was in that "Hard-To-Get Sacramento Section" I nearly created a riot. I almost died laughing when I thought about the other 599 hams in our county, which is only a small part of the section. I also tried having the Sweet Wife call CQ for me but gave up because when I turned her off all I heard were Romeos calling "QRZ the YL" and disregarding me entirely.

The Toughest Lungs award should go to some character in the Santa Barbara Section. He called CQ 127 times that I counted and was still going strong when I tuned off him. Could it be he used a tape and let it run while emptying the garbage or something?

After 10 went dead I struck pay dirt on 75. I belong to about 15 QRU nets and with a large turnout (to escape the contest, no doubt) I really reaped a harvest. Of course you might know some feller would copy my style, but by the time 50 members gave a report to the first one through the line most of them drifted off somewhere and he only got 7.

Sooner or later one gets the bands milked dry. Then I began listening. Here was a chap who broke into a round-table. (Sometimes they get 20 or more in those things, you know). He subtly snuck up on them with the news he was in the contest and would stand by for a report right then from all of them. Stony silence. He left. Enter the villain, who busted in big and friendly and said he was in the contest and since no one there was engaging in contesting he was going to promptly QSY off their frequency and not bother them for a number. You know, I got 23 reports out of one bunch and a local even gave me two contacts, one for himself and one for his licensed XYL.

Phonetics are very important. I worked a W8 and to this day I don't know the first letter of his call. Whatever ones he used were worse than none at all. And don't think there aren't such things as hard-to-understand phonetics. I broke into a round-table one time and gave my call as W 6 Gnarled Tsar Gnats. It did cause a heated discussion as to just what were my true call letters, which was probably a good thing because they were needing something to talk about.

But I've gotten off the subject. I was going to mention that at times there was a *slight* bit of QRM, but it's just like money. If a little bit is good, then a lot of it is better so I added mine to the rest. All at once the frequency would get perfectly clear and someone would call me. This is known as the "wear em out I'm in no hurry" technique. Pardon me while I answer the phone.

Well! Talk about shook-up! They checked up on my report and found out I used a multiplier of 5, the number of gray hairs this contest gave me. I should have used 67, the number of sections I worked. I now have a score of around 8×10^4. They cleared up something for me, though. That fancy lettering said "Booby Prize" and I have to send it in since I no longer am entitled to it. In fact I don't have anything now, unless 17th in the Sacramento Section impresses you! *Ed.*: RELAX—That's all there is. ■

Polio Telethon

Mildred Joiner, K5ESB
Lubbock, Texas

The South Plains Amateur Radio Club, Inc. contributed their services to the telethon for polio funds which was staged in the new Lubbock City Auditorium-Coliseum in January. Fran Warren and Bob Crosby were the stars participating and Johny Joiner, W5KPJ the chairman of arrangements for the Amateurs. Communications and zone assignments were carried out on the same plan which would be used in the event of disaster operation in the Lubbock area. Fourteen mobile operators received instructions for picking up contributions to the polio fund from two fixed-portable stations set up in the Coliseum. The City was divided into 14 zones to which the mobile units were assigned. Each mobile unit consisted of a team of a driver, radio operator, and two assistants. The XYL'S assisted the O.M.'s with the necessary clerical work. The following mobile units participated: Johny, W5KPJ, Chairman; Mildred, K5ESB, publicity chairman; W5JQD, Bruce, President of South Plains Amateur Radio Club; Lizzette, W5TYX; Clark, W5AMI; Wayne, W5TVO; Ross, W5PTK; Hunter, K5BFG; Alvin, W5DVF; Dick, W5ZOK; Howard, W5JXG; John, W5QPI; Walter, W5TUW; Dave, K5HHK; Rogers, W5NIC; Hugh, W5VGC; Griff, W5PXI; Homa, W5KTX. Other members of the amateur Radio Club with Chuck, W5NEX, co-Chairman of the Amateur operation, worked in the Municipal Coliseum operating the fixed portable units and handling other necessary details. ■

Bob Franklin, W5DVE and Bob Crosby (has a brother-Bing).

Lynn Huckabay, W5GBV and Ray Greentree, W5TUG with headphones (didn't say who the fellow with glasses is?)

DSB

[*from page 93*]

is set back to zero for DSB operation and run up to around 90 or 100 volts for AM operation. The adjustment plus turning the heater on or off in one 6Y6GB tube and checking the grid current is necessary when changing from one modulation scheme to the other. The dc grid current on AM should be about 1 ma. and at least 1½ ma. on DSB on any of the bands from 28 to 4 mc. A separate rf exciter with 6AG7 oscillators and doublers or triplers was used to drive the 6Y6GB amplifier. For either AM or DSB the rf modulated stage is driven as in class C operation so there is nothing difficult about the design of an exciter except that a VFO must be *very* stable for DSB operation.

In both rf units a grounded baffle plate was placed across the rf tube sockets in the amplifier to provide shielding between the grid and plate tuned circuits. All tuning condensers were of the single spaced variety. The antenna coupling condenser in the lower frequency unit made use of a small three gang BCL tuning condenser with all sections in parallel to get a capacity range of from about 100 mmfd to nearly 1200 mmfd, the larger values being needed in the 4 mc range.

The 50 mc transmitter has been used occasionally at W6AJF to work distances of up to 80 miles on ground wave and into several states on sporadic E openings. The writer will have to admit that a seven element long Yagi beam antenna didn't hurt a bit in helping to get 5 and 8 to 9 reports of signal strength with the little transmitter. ■

Bob Bain, W5CRK
1721 Western
Fort Worth, Tex.

Operation Linda

This is the story of a group of amateurs and their efforts to raise funds to help an injured girl—a stranger to them. This is also the reason why, for once in its long history of unbroken operation, the Transcontinental Phone Net on 3970 kc delayed operations for almost three hours on the night of January 15, 1957.

Three years ago, Linda Fern Waldrop, now 8 years old, was injured when struck by a car. Since then little Linda lay in a coma, unable to speak, open her eyes, or move a muscle. The efforts of doctors had been to no avail until recently when she regained some control over certain muscles and could open her eyes and focus them. Further treatment was obtainable only at Denver, Colorado. Linda's parents were unable to provide the money necessary for the trip and treatment. (Linda's father suffers from an old injury and can only work part-time on small jobs.)

It is at this point that the radio amateurs of Fort Worth and Tarrant County, Texas, entered the picture. Les Harbin, W5BNG, and Emory Burgamy, W5ATR, initiated what has come to be known as Operation Linda, a program to unite the local hams to work towards raising financial aid for her trip to Denver.

W5ATR, Emory Burgamy

Approval of the program had to be obtained from the local Better Business Bureau, and a permit issued by the city. Through the assistance of a member of the city's civil defense organization shears were applied to the snarl of red tape and the permit granted in a matter of hours.

Although there had already been advance publicity on the proposed operation in the Sunday newspapers the permit necessary was not obtained until late Monday afternoon, January 14, 1957. Tuesday night, January 15, 1957, was selected for the actual operation. This tight schedule left little time for detailed planning.

With official sanction achieved, efforts to secure wide-spread publicity for Operation Linda got underway. Local newspapers were approached and several short stories were published. W5BNG appeared on a local television program to explain what the amateurs were seeking to accomplish and presented an effective plea for public support. A local radio station offered its cooperation when contacted by the amateurs.

Arrangements were made for the establishment of several base stations with mobile units to work under their direction. Five base stations in Fort Worth plus one in neighboring Arlington, Texas, were to operate on 3970 kcs. One base station to handle the ten meter mobile units and a base station for six-meter mobiles were provided. By on-the-air contacts and by word of mouth the news of Operation Linda spread to the amateurs of Fort Worth. Other than definite commitments from some mobile units and a minimum of organizational effort at base stations no detailed arrangements were spelled out. Like Topsy, Operation Linda just "grew."

Beginning early Tuesday morning and con-

tinuing every hour on the half hour, a local radio station gave a complete story of the "treasure hunt" as their announcers saw fit to dub the attempt. Telephone numbers of the base stations were broadcast and the hours of the operation—6 p.m. to 8 p.m.—announced. This public service on the part of radio station KXOL undoubtedly had much to do with the success of the project.

The appointed hour arrived. Operators of the base station stood ready to dispatch their mobiles wherever needed to pick up a contribution. Mobile units were spread out over the city while other mobileers monitored their chosen band from their home receivers and stood ready to roll if needed. XYL's, YL's, and harmonics gathered at base stations preparing pots of coffee, cold drinks, sharpening pencils and making neat stacks of notepaper on which to list addresses. There was an atmosphere of expectancy . . . and some doubt.

Would the telephones ring? They did. Once actual collection by the mobile units was underway the telephones rang constantly. When a base station saw a "clear spot" developing with nothing more for his mobile units in the offing a call to KXOL brought a "spot" announcement plugging the desired telephone number and the bells kept pealing.

Some 40-odd mobiles participated in the collection of contributions. A detailed list of all participants is not now available. Rather than attempt to name a few and slight many, no effort will be made to identify all that participated. Those who took an active part know who was there and their self-satisfaction in a job well done will have to be their reward at this time.

With the temperature hovering around the 25 degree mark it was not the best weather (Texas-wise) for mobileering over the city. One mobile made two trips to an outlying suburb while another made a trip to a small town some 18 miles south of Fort Worth just to pick up one small contribution. No one complained.

Short skip was mercifully absent from ten meters that night. The operators on six meters had no difficulty either. As might be expected the QRM on 75 meters was slightly terrific. Especially when you consider that the Transcontinental Phone Net had been handling traffic on 3970 kc in the evening-time for several months. Add to this the Fort Worth 75 meter mobile frequency of 3970 kc and confusion and chaos seemed inevitable.

However, thanks to the complete understanding of the situation by Lou WØCPI, midwest anchor man on TCPN, the net suspended operations for almost three hours while Operation Linda ran its course!

By nine p.m. the situation was under control and all but a few mobile units had returned to their respective base stations to turn in their collections. By previous arrangement the Riverside State Bank of Fort Worth kindly made available the services of two cashiers. By eleven p.m. the money had been taken to the bank, counted, and deposited in a special account for Linda.

The goal aimed for was $1,000. If half this amount had been collected the efforts of all concerned would have been considered well worthwhile. Remember, this operation took place right in the middle of the national March of Dimes campaign, just after Christmas, and at income tax filing time . . . definitely not the proper moment for such an endeavor.

Well, what happened? The cash on hand at the conclusion of Tuesday night's operation showed a grand total of over $950.00! This amount plus various pledges to be picked up the following day brought the final total safely over the original goal.

W5BNG, Les Harbin

The primary goal—raising enough money to insure the trip to Denver, Colorado, for little Linda has been achieved. Contributions are still coming in from various organizations. For this the amateurs of Fort Worth are most grateful.

This operation was conducted by the amateur radio operators of Fort Worth and Tarrant County. Every amateur, mobile or not, helped in some way. If they did not take an active part in the proceedings their monitoring of frequencies, availability for service, or just keeping quiet contributed to the project. Operation Linda was not sponsored by the local Kilocycle Club, AREC, the 75 meter group, ten meter group, nor the six-meter group, nor by a group of traffic handlers. It was a joint effort . . . concrete evidence that amateurs not only can but also will function as an entity if the need arises. ■

and HALO to You, Too

Bigelow Green, W1EAE
12 Gloucester St.,
Boston, Mass.

Introductory Notes

(a) This is not a technical dissertation. Not by a 93 kc dipole.[1] All tick-slippers and theoretical types can stop reading right here.

(b) It is, instead, a go-thou-and-do-likewise account of a quick and easy 2 meter halo antenna which works just dandy.

(c) The device was built in less than one hour with no pain and very little strain. It was, however, the result of acute frustration which came upon us in the following manner:

Prologue

Gonsetting up to the White Mountains with a vertical ground plane on the roof of the car we were unable to raise a single, solitary soul! Next day we met Gordon Pugh, W1JTB. Gordon is a TV engineer stationed on the summit of Mt. Washington and is a ham of the very highest type.[2] He was most sympathetic and arranged skeds. Only two decent contacts were possible however and both occurred while we were parked. Attempts at mobile QSOs gave poor to awful results, mainly due to flutter.

The following day, still vainly croaking "CQ", we drove to Orange, Vermont, near Barre, and dropped in to see Ann Chandler, W1OAK, and George, W1MMN. Ann, SCM and RM for Vermont, is a mainstay of the traffic nets and is active in CD. She is also a mighty hunter, town official, braided rug expert, dachshund fancier, maitresse de cuisine[3] and a charming hostess. George, a communications engineer for the State, has a 30 element, 2 meter array perched sixty-odd feet up toward the tropopause.[4] This beam is usually headed west looking for scatter from Hawaii, or maybe Japan or someplace, but we persuaded him to swing it around and try to work us on the way home. Again, only two contacts could be made and mobile results suffered from severe pediculosis.[5]

Design Considerations

Back in Boston, with a trip to Cape Cod coming up next day, the mobile antenna problem was given crash priority.

Verticals were out! We'd just *had* it.[6] Beams? Not for mobile use. How about a halo?

We reached for the April '57 CQ and reread Bishop's article on page 19. Just what the doctor ordered but, unfortunately, not to be built in one evening.[7] Other references were consulted but all the designs we could find presented constructional problems or required precise matching adjustments which we just did not have time to tackle. Something disgustingly simple was needed.

We had a moribund[8] TV Yagi with a folded element which could be chopped to size and plenty of ¾ inch mast stock;—but what about matching to the Gonset? A coax balun would perform the necessary 4 to 1 impedance transformation but working with coax can be messy and we did not like the idea of a great gob of feedline flopping around up topside.

At this point our eye fell on the family TV set which had been brought up to the shack for repair back in '54.[9] In the antenna circuit there were two little matching coils,—BALUN COILS!

1. Mile (approx.) ..... Ed.
2. Elevation 6,288 feet ..... Ed.
3. Good cook ..... Ed.
4. A place way up there ..... Ed.
5. Look it up for yourself ..... Ed.
6. But Good! ..... BG
7. Not by us, anyway ..... BG
8. Back to the dictionary, boys ..... Ed.
9. Nobody missed it ..... BG

Construction

The coils[10] were quickly mounted on a scrap piece of component board and installed in a 4 by 2⅛ by 1⅝ aluminum box[11] as shown in the close-up view. They were then series-connected to a pair of feed-through insulators in one end of the box and parallel-connected to a coax fitting in the other end, in accordance with fig 1. The BNC type connector was used only because it was handy; a standard AN type would, of course, be FB. The feed-throughs came from the junk box but there are several equivalent types available for pennies.[12]

The TV dipole happened to be made of ⅜ inch tubing with 2 inch spacing and with 2½ inches between the feed points. After a slight struggle with the four-legged stool effect,[13] we cut it down to something reasonably symmetrical which measured 38 inches overall when lying flat on the workbench. The photograph shows a short piece of aluminum angle which was used to fill in the chopped upper element. Any other strip of metal would have been just as good and, of course, if a dipole were to be made up from new tubing, no such piecing-strip would be necessary.

The folded dipole was circularized by wrapping it around a Tartan Toter.[14], [15], [16] Allowing for a 1½ inch gap between the open ends, the diameter came out to be approximately 12½ inches. This topological monstrosity[17] was then attached to a piece of scrap lucite which in turn, was bolted to the top of a six foot mast. The "balun box" was also bolted to the mast a bit lower down to keep it out of the horizontal radiation field we hoped would be there and, finally, 300 ohm twinlead was connected between the dipole and the feed-throughs.[18] And that is all there was to it!

10. RCA Part 73591 .... list price $1.50 per pair .....BG

10A. Millen makes miniature Balun coils complete with connectors too, see your distributor .....Ed.

11. ICA type 29377 .... about 70 cents .... any similar box would do .....BG

12. For nickels, anyway .....Ed.

13. The leg she's too long, you cut him off, she's too short .....Ed.

14. CAUTION: Do not attempt to bend around wastebaskets, they can't take it .....BG

15. You could use a tree, but would have to chop it down to get the halo off .....Ed.

16. It is suggested that the halo might be wrapped around the waist like a sarong, and then squirmed-out-of, like a girdle .....Janitor

17. Aw, skip it .....Ed.

18. The length of the twinlead does not seem to be critical. Originally 12 inches, it broke off in the field. We just moved the box up four inches and reconnected with no apparent effect on operation 19 .....BG

19. Better stay away from a quarter wavelength though. Things could start fouling up .....Ed.

Operation

For social considerations,[20] mobile operation was not attempted on the trip down to Falmouth, Mass. near the south west tip of Cape Cod. That evening, however, with the mast set in a gutter downspout at the corner of the house and the halo about 25 feet off the ground and 40 feet above sea level, we worked W1OQT over on the island of Martha's Vineyard (8 miles) and several Cape stations in various directions and up to 15 miles away. All reports were Q5 with the R varying from 4 to 9 plussity-plus depending on distance but not on direction. At 9:35 PM we nailed W1EC1, portable in Meriden, Connecticut, 110 miles to the west'ard.

Next day we celebrated the fourth of July by adding W1BDF on Nantucket Island (30 miles ESE), W1AJR in Middletown, R.I. (35 miles W), W1FVY, portable on Block Island (55 miles SSW), and W1ZPV in Niantic, Connecticut (85 miles SW) and nary a beam did we have to swing!

Mobilewise, the halo is a delight indeed. It is omnidirectional for all practical purposes and is essentially flat across the band. Flutter is greatly reduced and signal degradation due to cross polarization seems a bit less severe than when using a vertical. Finally, ignition QRM shows marked reduction both from one's own motor and from passing traffic. We have had a number of really comfortable, arm-chair

[*Continued on page 160*]

20. XYL said: "It's my vacation just as much as yours and I'm sick of that terrible squawking and, besides, I will *not* drive up to anyone's house with that funny looking thing on the car."

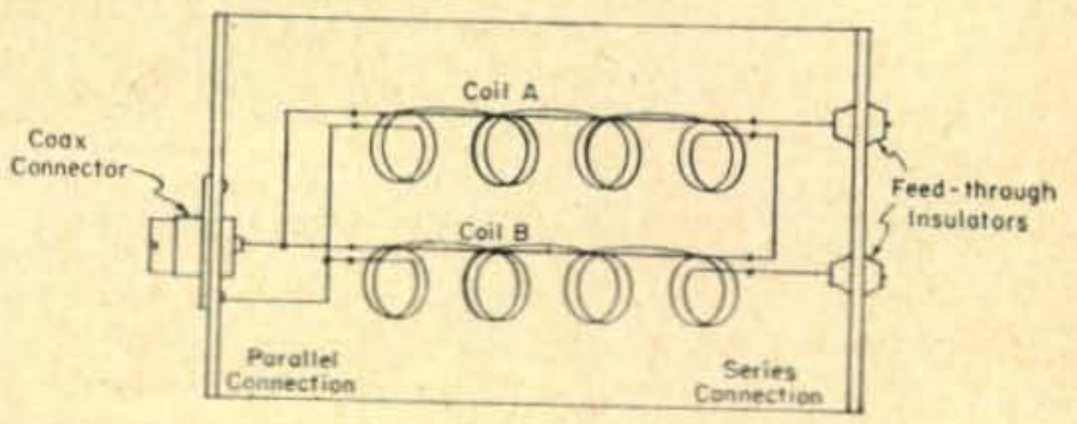
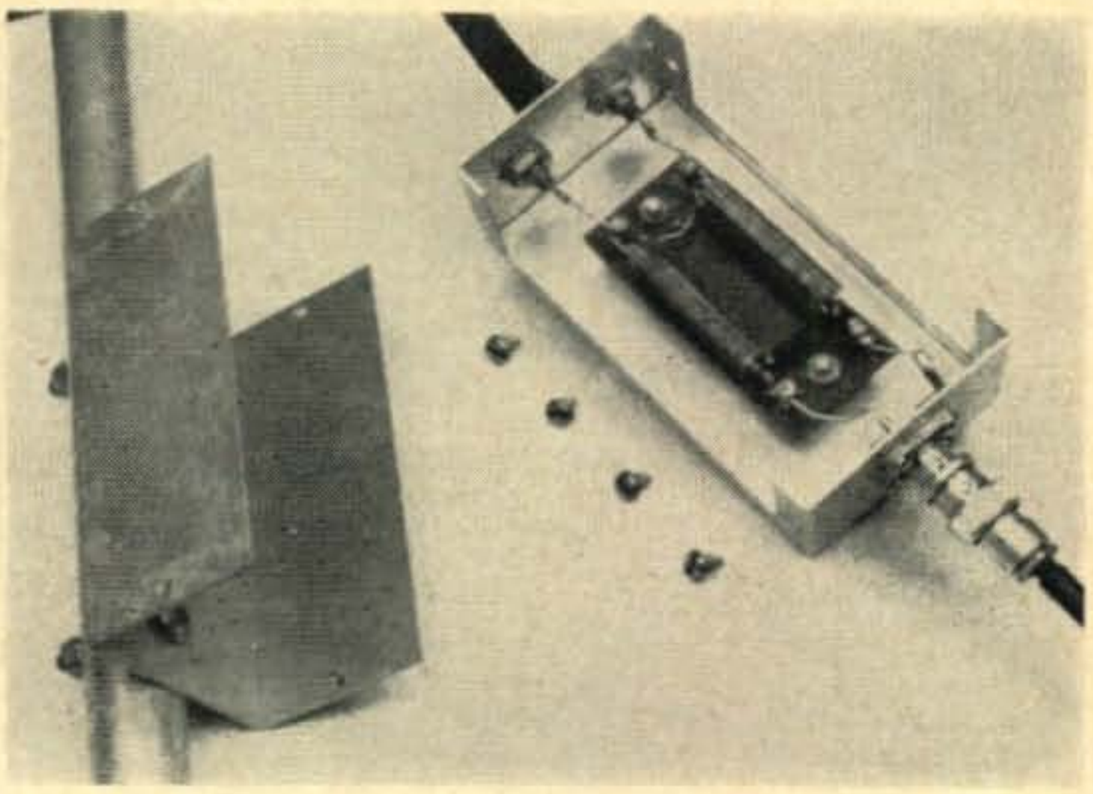


Fig. 1



James M. Collins, W3DBL
Box 16
Landenberg, Pa.

Nothing...

But The Facts

Caught your XYL whistling dit-dahs to herself lately? Or maybe she was poring over the handbook? Or spending some of the grocery money on a new license manual? Before you go tearing off to find those back issues of CQ that told how to nourish this interest, *stop*, and get the real facts of the matter.

I am one of those rare birds whose XYL not only is interested in ham radio but also has her own ticket. Fellows are always telling me how lucky I am to have my wife interested in my hobby and asking me how I did it. Well, I'm willing to tell anyone how I did it, except that I often have a sneaking suspicion that I didn't have anything to do with it at all. What Florence wants, Florence gets. And as for being lucky, brother, it depends on how you look at it. Sit down here and let old uncle Jim point out a few facts about radio which aren't in the handbook.

First of all on that little matter of buying equipment. Sure, when the XYL is on the air too she's just as interested as you are in having the best equipment you can afford. And I must admit I don't know many hams that can surprise the XYL with a new receiver for Christmas and hear "Darling, it's just what I've wanted for so long." And she means it. But you take the receiver out of the packing case, hook on the antenna and who sits down and starts to play with it? Not the OM who slaved every day in a hot laboratory to earn the shekles to pay for the thing, and who broke his back carrying it into the house. You're lucky if you can even listen to it. She might decide to try it out with the earphones instead of the speaker. Of course, it was *her* present but after all . . . .

Looks

Then there is the little matter of the bargain KW being offered in the "used but still usable" department of the local radio emporium. A beautiful job of building, bandswitching 80 through 10, excellent audio system, forced air cooled bottles, and all for less moolah than it would take to buy the parts. It does stand about six feet high and the fellow who built it didn't bother to dress up the outside much but oh, the insides! Wow! However, does it impress the XYL? Nope. "But, Jim," she says, "I thought we were going to go high power the easy way—on 6 meters. Charley just told me they are getting those 6 and 2 meter kits in next week and for what that KW would cost, we could get one of those kits, and a beam and mast and a rotator. Then we'd have high power and no QRM to fight." She did have a point there. You've guessed it. You can now find me most any evening on 50.3 mc.

You can find me, that is, if the XYL isn't monopolizing the rig. Theoretically we have a

schedule which works out this way. Florence is home in the morning so she does her operating then. When we get home from work in the evening, I get a chance at the rig while she does the things around the house she should have done in the morning but couldn't because she got on the air and time just got away from her and first thing she knew it was noon and time for her to go to work. That's fine in theory. Now listen to what really happens. I get the rig loaded up nicely, call CQ till I'm hoarse, but no results. Then the XYL offers to give it a try for me. She calls, flips the switch, and then get them all arranged in line for a round table. Me? Oh, I go out and make her some coffee. She gets tired after about an hour's steady talking. Of course it doesn't always work out that way. I do make contacts too. But if I get careless and tell them that A, the XYL has a call, and B, she's there in the shack, they immediately lose interest in a mere OM and want me to put the XYL on. And as I say, I go out and make coffee.

Contests

However, I do have one thing to be very thankful for. The contest bug hasn't bitten my XYL as yet. From what I understand from other OMs in my position. there is no cure. You just have to remind yourself it only happens a few times per year and bear up bravely. For a period of from 36 to 48 hours you lose not only your wife's attention and company but her other talents, such as cooking, bedmaking, childcaring, and telephone answering as well. Dust accumulates, dishes overflow the sink and even the kitchen, little Johnny breaks his arm, the baby screams the whole time, your wife's great-aunt Martha calls to announce she is coming for a week's visit, but does your wife care? She doesn't even know what is going on. As long as the rig works and you pass her a cup of coffee now and then, she leaves the rest of the house in your capable hands. But the thing that really cuts is listening to those states you couldn't get, and those rare DX stations all chasing after *your* wife. I'm thinking of investigating the possibility of some form of immunization injection to keep my XYL protected from this terrible disease.

After a while I guess you get used to being the less important member of the family. I understand there are quite a few other men, including the Duke of Edinburgh, who find themselves in this position. But it's a little hard to go to radio club meeting and be introduced to a new member this way. (You understand the guy doing the introduction is a fellow who I QSO with rather often besides seeing at club meeting every month.)

"Bill, I'd like to have you meet Jim, W3-uhhh. Gosh, I can't remember his call but you know W3DBN, Flo? Sure, well he's her OM. What is your call, Jim?"

I silently grit my teeth and remember to be thankful he at least remembered my handle.

Credit

Meanwhile, Florence has at least three other hams all around her listening to her expounding on most any subject from antennas to Z-match couplers. Naturally I'm proud that she can talk intelligently on technical subjects but I do remember the sweating and swearing I did getting the theory through to her. And I can't help wondering whether they are really interested in what she's saying or is it just because she's a shapely redhead? However when she comes and gets me to explain things further "'cause Jim knows all about trap antennas" or whatever, I do throw my chest out just a little.

I haven't mentioned yet the minor matters, such as never getting to read the radio magazines till she has scanned Scratchi, the YL pages, and lately the VHF columns — and of course, the Classified Ads. Or when we visit our brother ham with the KW and 5 element beam on 20 meters, who gets to talk to the ZS6 he has on the hook? Natch, the XYL. The band goes out before I get a chance to say Hi. And this business of having the shack centrally located in the living room so she can ham and still get some housework done. Convenient? To a point. But can I ever let our shack go looking like those of most of my friends? Well, it is the first thing that hits your eye as you walk in the front door—and we do have some friends who aren't hams, you know. So figure it out for yourself. But as I said, these are just minor things.

Demurrer

Wait a minute though. When you get right down to it, are any of these things I mentioned really very important? It is pretty nice to be able to talk radio morning, noon and night to someone who not only listens but understands and can make intelligent suggestions. When I get bogged down with a #$%& building project that just won't check out I certainly appreciate Florence soldering on that tricky lead way under all that other wiring and her making notes on the various meter readings. Although I spent a lot of time drilling her with theory, she spent just as much time helping me with the code. And next month I want to see about getting a 2 meter beam and converter. Florence thinks that's wonderful. Pretty lucky, aren't I? Well, I'll tell you—if you really want to get your XYL on the air too, why don't you look up the December 1955 issue of CQ? There's an article in there by W3DBN on — hey, what am I saying? ■

the Doddering Recollections of an Old-Timer

or "When We Were Young and Gay . . ."

Carlson E. Holmes, ZL3DK
18 Southey St.
Christchurch, New Zealand

On the walls of my shack, presumably for the benefit of a particularly disinterested posterity, hang two Old Timers' Certificates — grim reminders of the undeniable fact that, after a man reaches a certain age, the years positively scream onward.

The Old Timer realises just how briskly the water is roaring under the bridge when he is asked to respond to the toast of "The Old Timers" at hamfests and other functions where members of the radio fraternity meet to swap bigger and better stories, most of them untrue, alas!, of their attainments in radio. Usually, a younger man proposes the toast and pays a sterling tribute to the Venerable Bedes who are honouring the function with their somewhat senile presence.

The proposer hands out a corny speech about "what we owe to the Old Timers who blazed the radio trail so that we who came later are left with a great tradition to live up to."

There is then a big round of applause, too hearty and far too spontaneous. All the very young operators present look at the doddering Old Timers like small boys leering at a bevy of broken-down Father Christmases. They leer all *t*he harder when the Old Timer chosen to reply (and on two occasions I have filled this saintly office) creaks to his feet. There is a polite round of applause while the old gentleman assumes a stance very reminiscent of the statue of a politician having trouble with errant pigeons. Having adjusted himself to a position less shattering to his sciatica, the old geezer then delivers a speech which plumbs hitherto-unexplored depths of monotony. He dwells long and lovingly on The Past—When We Were Very Young. He trots out a few reminiscences to prove "that In Our Time" there was only one standard of operating — just the very best, of course!

After twenty such recollections, each more dreadful than the last, he assures his hearers — or, rather, those of his hearers who are still awake — that "We who are now becoming old are quite prepared to Hand On The Torch to The Younger Generation because it is A Trust that they, in turn, will have to hand on to others."

He then goes through the motions of handing on the torch and sits down as fast as his tottering limbs will permit. The other Old Timers mumble senile congratulations and the boys thank Heaven that the old chaps will be silent for the rest of the night.

What would happen on such an occasion if an Old Timer had the nerve to tell the truth? It would be preposterous — but it would be fun! The youngsters present would cease regarding the Old Timers as broken-down crocks and would extend to them the affectionate respect that young people usually reserve for uncles who, in the avuncular youth, were definitely reprobate but who are now reformed pillars of respectability.

Instead of Handing On The Torch, I'd like (if I were brave enough) to tell the boys of the regulations we broke and the tricks we put over in those dear, distant days beyond recall when your real operator ran with his plates a nice cherry red and it was normal to have key thumps that would kick a mule cold. Happy days!

Personally, I'd like to inspire youthful operators with some stories of my old tuned-plate, tuned-grid transmitter. This wonderful old job using a pair of 45's (now, there *was* a tube!) not only took my signals to the far corners of the earth but effectively cleared the air for miles around of potential interference simply because most of the locals could not compete against it. Its note was a dream — like a buzz saw with a neurosis and half its teeth missing. It was the purest of raw a.c.; but kindly amateurs, provided they were over three thousand miles away, were good enough to describe my note as "near direct current". This attempt to maintain good international relations was very much appreciated. On the other hand, some of the locals (who didn't have to consider international relations) described the note of my transmitter as "lousy" but that was only jealousy because my note was buzzier than theirs. Ultimately, of course, the relevant authorities caught up with me and in a neat official communication (which I still cherish) indicated that equipment to ensure a d.c. note would have to take a priority on my shopping list. But, despite the complaints of amateurs and the authorities, I loved that buzz-saw note. There is nothing like it on the air today.

Like everybody else, I had my moments on

80 meter phone. These stand out as some of the brighter memories of my radio career. With others, I used loop modulation, a system of modulation which is, unfortunately, lost to the world today. The equipment for this highly specialised form of telephonic communication consisted of a vintage carbon microphone with a loop of insulated wire hitched to the two microphone leads. The loop was place adjacent to the tank and there you were — telephony! Technical difficulties arose, of course. The earnest loop phone operator always kept a pencil in his hand to tap the microphone when the carbon granules packed up. In some cases, the telephony petered out because the microphone became so hot that the operator began to resemble the boy on the burning deck. Most loop modulation was awful and bore a resemblance to quite a lot of the single side band telephony of today. Nevertheless, loop modulation had its devotees and some of them secured remarkable results.

And those receivers — the good old "detector and two"! These were fired by batteries which had the remarkable knack of failing just when DX was at its best. Yet, given good batteries, the old regenerative receivers really worked. They were certainly worthy pioneers of the ac receivers of today.

Things could really be done with those old regenerative receivers. Take the case of a ZL3 — who, at a meeting away back in 1931 said that he was going to dedicate the next few nights to chasing dx "which really mattered." Two other ZL3's got together and determined to help him in every possible way by keeping off the air and by actually providing the rare dx. You guessed it — the old regenerative receivers were brought into action. The two dx providers each put a key in the ground lead of his receiver and — whacko! rare dx. When ZL3 — called CQ they answered with calls that usually were spoken of in awed whispers.

The first night, ZL3—, in a happy daze, took everything that was served up to him; but he was just a little cagey the second evening. Two or three days later, he was still pondering over it. He just couldn't decide whether he had really broken through the dx barrier or if he was the victim of a foul plot. He soon found out. The "DX merchants" simply had to share their innocent fun with others and ZL3— soon discovered that he had been taken for a radio ride. He was sporting about it. He showed that he could take a joke. He simply waited until he heard the two humourists on the air. Then he blotted out everything they were trying to work. Yes, comradeship and the amateur spirit were mighty strong in the old days.

Then take the interesting case of a lovesick amateur whose own true love was absent from the city. She was in another town on holiday and, though parted by distance, he arranged that her voice should come to him through the miracle of radio. He accordingly arranged a schedule with a brother-ham in the town where she was staying. For three or four nights her voice, fruity with love and devotion, came hurtling through the ether (at 186,000 miles per second) to his pulsating ear-drums. Then came the dreadful, though logical, thought. Suppose in the shack at the other end, her maiden heart began to beat more quickly as she watched the skilful juggling of switches and controls and the graceful yet nonchalant use of an absorption wave-meter by a super-man of radio who, perhaps, had wavy hair and padded shoulders. The green eyes of the monster of jealousy began to shine more brightly than the ruby-red plates of the lonely young man's transmitter. Two telegrams, one to the girl friend and other to the obliging amateur announced that, owing to a break-down in the transmitter, the schedules were definitely off. Not so very long ago perhaps — but even in the pioneer days of amateur radio, the searing conflict of human emotions was not unknown.

The Old Timer of today, smugly conscious of his patriarchal status in the radio world, seldom admits that in his day there were those who made mistakes and hitched up wires to the wrong connections. Yet I recall, with nostalgic pleasure, the performance given one evening by an amateur who, today, is respected (and rightly so!) as a veritable founthead of radio wisdom.

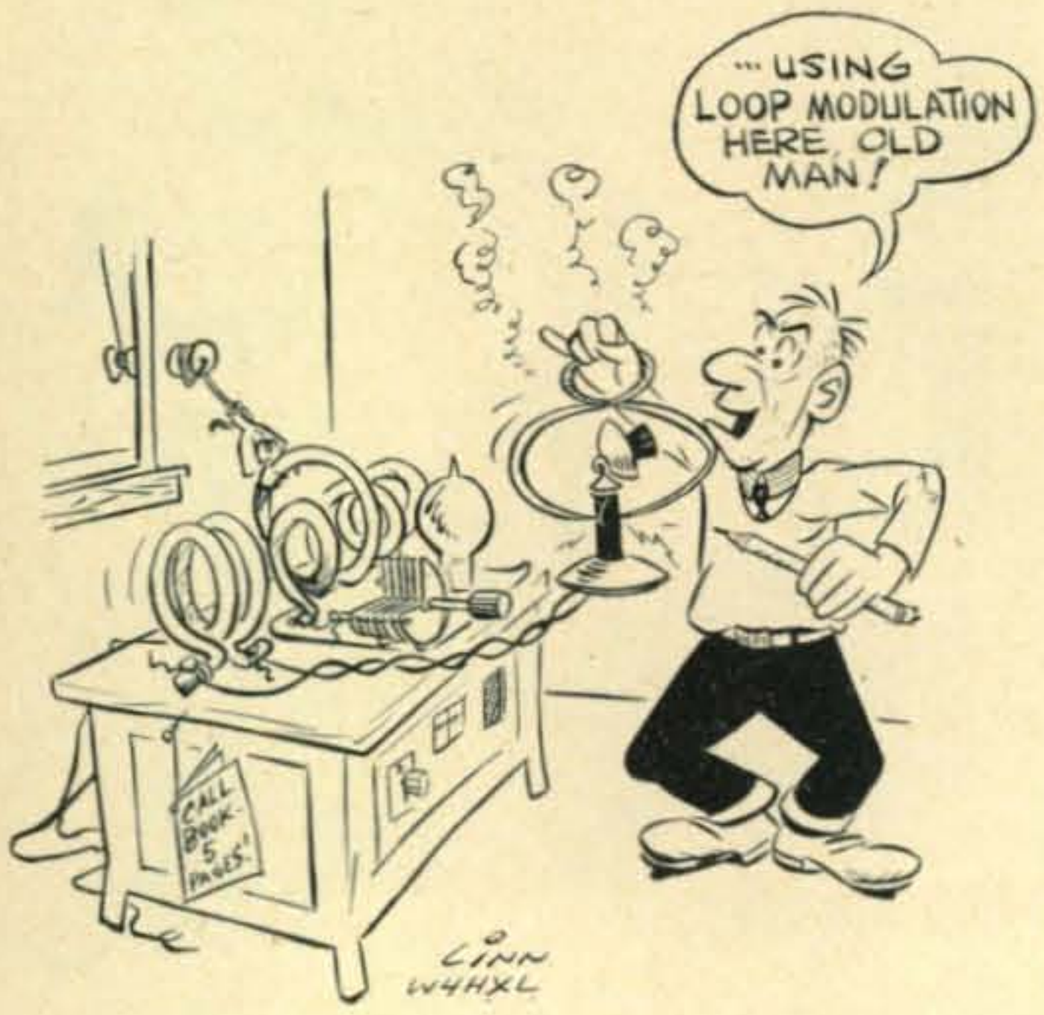
He was using a Hartley self-excited rig with a tank coil made of copper tubing which, by virtue of its diameter, would have been more at home in a sewerage-disposal plant. His aerial coil was also of striking dimensions and, to modern eyes, would have been regarded as a vital piece of equipment for a space-ship. Now, in those days as old timers will remember, we hitched up with big metal clips, the bigger the better. He had one of the aerial clips in his hand and instead of hitching it up to the aerial

coil, he absent-mindedly tried to join it to the tank coil. The power was on. The tank coil was hot — very hot. For some five seconds he performed jumps and gyrations which would have put him in world class in any corps d' ballet. Nijinsky himself could never have bettered his quivering toe-work as, with one hand on the tank, he contorted some two feet above the floor. Unfortunately, the contact broke all too soon and the blithe spirit of the dance became just another disillusioned radio amateur who found out, the hard way, that carelessness brings shocking results.

And now for one of Army days. In the early days of the recent war some of the military sets were an amateur's dream in that they'd work like a charm one day and sulk the next. They also weighed rather much in that in the good old Army style they'd been made of honest solid steel which ensured permanence rather than portability. It was arranged that a demonstration be given one night for the enlightenment of a visiting colonel. A careworn Captain arranged several transmitters two miles apart and impressed on his operators the need for putting on a really good show.

One transmitter-receiver the first the colonel would see, was placed in charge of a soldier (now an Old Timer) who, in private life was a radio amateur with his own personal radio call. This rather impressed the captain who was an honest soul unaware of the more vital facts of life. I say that because the amateur in question was (like myself) an inveterate knob-twister. If there was a dial in sight, he just had to twist it. This urge, which can be termed an occupational disease as far as many radio men are concerned, ended in the radio demonstration being the flop of the century.

A daylight rehearsal was carried out. Everything went like a dream — a fact which those more experienced in radio than the captain, would have taken as a grim warning that a champion muck-up was due to break. In his innocence, the captain was delighted with the rehearsal and gave as his considered opinion that his pleasure would be shared by the colonel — as if a colonel ever shared pleasure with anybody!



Came the big night — a night as black as a bottomless pit. The operators were dropped at their stations where they sat in the darkness waiting on the colonel who, with the wisdom that comes of age and rank, was back in the officers' mess fortifying himself against the rigours of the cold night air.

The operator of the first station felt that old urge to turn knobs. In the darkness broken only by the glowing tip of his cigarette, he fought down the craving to make a few "adjustments." He lost — the urge took over. He gave a twist here and a twist there and felt satisfied.

He heard voices and stubbed his cigarette. Then the colonel and the captain appeared — just two dim shapes in the overwhelming gloom. The operator sat tensely as if to impress on the colonel that here, at any rate, was one man standing watch and ward over the Empire.

"Ah," the colonel said. "Everything working nicely?"

"Yes, sir," the operator replied.

"Then tell the second station I'll be up to see them soon."

"Yes, sir . . . "

The operator grabbed the microphone in the approved manner and started calling and saying, "Over!" Ten minutes later, he was still calling (in the approved manner) and saying "Over"! Come to think of it, twenty minutes later he was still doing the same thing!

"Can't you get anything on it at all?" the colonel asked.

"Oh, yes, sir," the operator (a true radio ham) replied. "A while back the receiver was bringing in some really good dance music!"

The colonel turned to the unhappy captain. "Let's get out of here," he said in that icy voice characteristic of colonels when they are not amused. "If the rest of your demonstration is as poor as this, I think I'll use bicycles for messages. They appear to be faster than radio! And I thought you said that the operator on the first station had a wireless operator's certificate? He seemed a bit of a pill to me — him and his silly dance music."

Thus the unfortunate captain found out, all too late, that a radio amateur can be a liability in any Army.

These, then, are a few stories of the men and events which memory brings back. Every Old Timer has had his radio career brightened by such highlights. Yet, when Old Timers rear themselves up on their aged feet to speak, they (and I am as guilty as any of them) deliver high-sounding guff about "The Good Old Days" and "Handing On The Torch."

Why not keep the boys awake by relating some of the real facts of our radio youth? ■

Are Hams Becoming Phony?

Mike Caveney, VE3GG
29 Byng Ave., Willowdale,
Ontario, Canada

Many people seem to be under the impression that any ham that operates a commercial rig is not a "real Amateur" and is only cheating. These people are entitled to their opinion, but they had better take a second look at the many thousands of old time hams who are doing exactly what is being complained about; using commercially built equipment throughout their stations. He might visit some of their attics and basements, where, piled high, is the junk yard of forty years work building amateur equipment.

Probably before the *purists* were even born and before such things as vacuum tubes could be bought, these men were busy collecting tin foil from cigarette and tobacco packets, stealing glass windows from condemned houses at night, and spending whole week-ends pasting thousands of little sheets of tin foil on the stolen glass to make a condenser for a half kilowatt spark job. Did you ever try to wind 17,000 turns of wire on a transformer secondary by hand? Try—in some idle moment.

Over thirty years ago the hams were seeking far and wide for old Edison car batteries, spending weeks of spare time chopping off each single positive and negative element with a cold chisel. Hundreds of them had to be paired off into small glass test tubes, one positive plate, one flat negative plate in each tube and all then connected in series. The negative plates were so hard, your drill could only protrude one quarter inch from the chuck, and had to be re-sharpened every four holes.

As for receivers—you made them yourself, with wax paper and tin trips for fixed condensers and the lead from pencils for grids leaks. Variable condensers were made by rotating half a salmon can inside a larger half section of a slightly larger condensed milk can.

To copy the commercial stations on 21,000 meters down, it was necessary to have a five inch tuning coil standing five *feet* high, with a slider tap running up and down the thing. Such coils could be wound while you were cleaning your teeth.

There were no radio catalogues from which to buy this and that. Later, you could buy coherers and variable condensers which must stand on the table in a bakelite oiled filled case, and a good snappy crystal which came in vogue was worth a million; but, in the early day, you *had* to *make* it yourself, even QST was only a four page pamphlet some 35 years ago, with no advertising.

You had spare time but you didn't have the money, so you made your own quenched gaps, rotary wheels for spark gap, and re-wound some old motor to suit the purpose. All this stuff worked just as it does if you build it yourself today.

As the years passed, the radio engineers the world over met in profound conferences, and decided that frequencies below 200 meters were useless and should be given to the men I am talking about, the radio hams. They moved the hams down to 160 meters as the broadcast stations didn't have enough room to sell soap; one particular soap programme is 30 years old.

So—the radio ham had to re-design for the higher frequencies, he went to 80 meters, then 40 and later to 20 and started to circle the globe on five watts in *daylight* using a piece of wire stuck on the bedroom wall.

The radio engineers and the commercial stations, who could not span the Atlantic half the time with their 500 foot towers and 100 kilowatt stations operating on the only "useful" frequencies, went into a huddle, grabbed large portions of the "useless" ham frequencies, compressing the hams, hoping they would QRM themselves out of existance.

It was not to be. The ham battled with receivers to get more selectivity, starting with the superhet, on through to SB and crystal phasing, etc. Commercial firms hired the smartest of them to build such equipment, and found the money to pay them to bring their dreams into reality.

The last war was responsible for the swiftest development of the radio era. It was the hams we are talking about, who, when war broke out, were ready to climb into a bomber, a submarine, or a battleship and take over while others took on the job of training radio operators from the thousands of hobbyist such as photographers, butterfly and stamp collectors, enthusiasts of the hockey rinks, bowling alleys, pool rooms, and back seat smooching. It cost the nation thousands of dollars annually and many months of time to train such men. Only the ham was completely ready to fight when the war came, at his own time and expense

[*Continued on page 158*]

Most Hams think a Pi-Network will feed any tube to any antenna, which it won't! Here is a discussion of this network, its limitations and facilities. Also an alternate type is presented which more nearly matches most ham antennas to the final RF output tube.

Karl A. Kopetzky, K9AQJ
Donald L. Klipstein
Engineering Department,
WRL Electronics, Inc.,
Council Bluffs, Iowa

Why Pi?

Like we say," Why Pi"? . . .

'Way back in 1930, or thereabouts, Art Collins, of Collins Radio fame, popularized the Pi-Network; and his unit, within the state of the art at that time, was considered a device to match closely an rf output to an antenna. For those of us old timers who read his original article in the *Proceedings of the IRE,* Art stated that the network was to couple a resonant antenna and feed-line, which was therefore resistive only, to the rf amplifier.

As time moved on, the Hams more and more leaned towards the idea that the Pi-Network was a cure-all for all their antenna loading ills; that it furnished the ultimate answer to match *any* rf tube to *any* antenna load. This belief has been seemingly strengthened in later years by the appearance on the market of large numbers of manufactured transmitters terminating in Pi-Networks. However, the Hams have for the most part failed or neglected to read the "fine print" in the instructions that the Pi-Networks were only suitable to match *resistive loads;* and they have gone merrily on their erroneous ways thinking that these networks match "anything to anything" (CQ Magazine, April, 1957, pp. 32 & 108).

Nothing could be further from the truth!

The Original Collins Pi-Network

The original application of the Pi-Network, as conceived by Art Collins, was an impedance-matching device to follow an already resonated and tuned final plate tank. (*Fig 1*)

The antenna was supposed to be closely resonant to the operating frequency.

Please also note the refinements which were included. For example, the taps on coil Lp were independently operable of any band-change switch; a meter or bulb at M showed if the antenna was taking power. Tuning instructions were very specific: First the tank was resonated by capacitor C with the Pi-Network disconnected from the antenna at A.

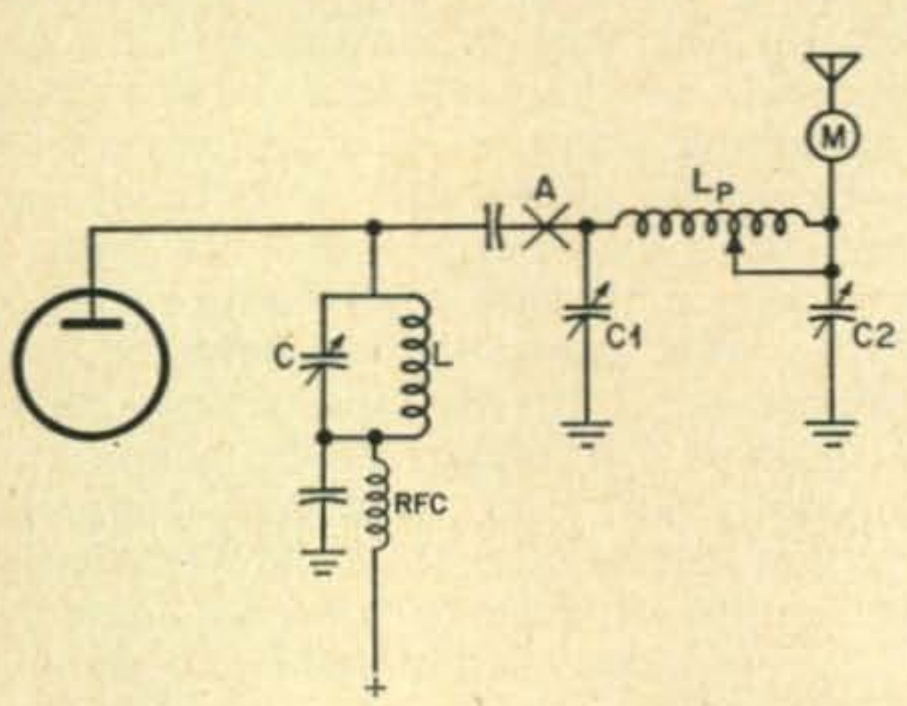


Fig 1. The Original Collins Pi-Network

After resonance was attained by this capacitor, it was never touched again for that frequency. Then re-connecting the antenna through switch A, capacitor C1 was resonated while capacitor C2 was used to load the circuit. Taps on inductance Lp were varied until a point was found where capacitor C1 was resonated, capacitor C2 loaded to the predetermined point while meter (or bulb) M showed that the antenna was taking current.

It was carefully explained that there were settings where capacitor C1 would resonate and capacitor C2 would load to the desired figure, *but nothing would be going into the antenna, the Pi-Network itself taking the load.* These were described as "false resonant-load points," and the Hams were warned to avoid them like the plague.

Furthermore, it was shown that if no tap could be found on inductance Lp which would provide a setting of capacitors C1 and C2 which would furnish the necessary loading-resonant point, because *any* setting resulted in either too high or too low a load, then the Ham was told to *tap down* on the plate tank L until such a correct point could be found.

In analyzing this old-time Pi-Network, it is easy to see why it worked. The plate tank LC had a definite impedance which matched the tube load. $Z_{rt} = \frac{\omega L}{1-\omega^2 LC}$ This impedance was then matched to the input of the network, and through the network to the resistive output which was the antenna load. This matching was accomplished by varying the inductance, the capacitances or both. As a last resort it was possible to create a matching impedance from the plate tank to the input of the network by tapping down on the plate tank as explained above. $\frac{Z_1}{Z_2} = \frac{L_1}{L_2}$ No attempt was made to have the network act also as a plate tank. And when used as designed, the Collins Pi-Network was a jewel. The extra inductance and the two capacitors made the

cost a bit higher, however, than most Hams could afford. Yet one of the authors remembers vividly the Gross transmitter of 1930 which had the true Collins network, and with which he loaded a random length of wire and worked around the world with ease!

The "Corrupted" Pi-Network

Somewhat later, some enterprising Ham corrupted the "double tank" system of Collins to the single Pi-Network which at one time both tuned the plate tank as well as matched it to the antenna load. This is the "modern" version and two types thereof are now very common. (*Fig 2*)

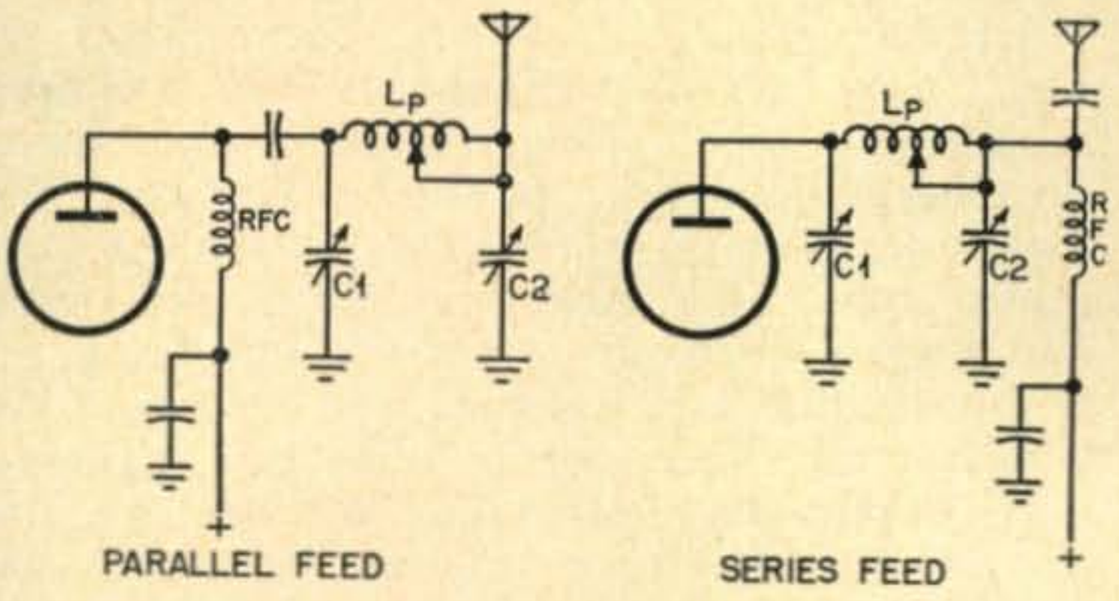


Fig. 2. The "Corrupted" Pi-Network

The results of this network were, more often than not, very unhappy, as Pi-Network after Pi-Network refused to load "just anything" as they apparently were supposed to do. Also the pink tickets for illegal or spurious harmonics increased. The convention at Atlantic City, 1947, limited harmonic power to –40db from the transmitted fundamental, or a maximum of 200 milliwatts, whichever was smaller, in the range of 10kc-30mc. Why was this?

Let us look at these so-called simplifications which constituted, really, a corruption of the original Collins Pi-Network. It is still quite true, as stated in *all* text books, and the Ham Handbooks, that such Pi-Networks will usually match a tube to a purely resistive load such as a resonant antenna fed with a flat line of definite impedance.

But, let's face it. Who among us Hams,—except we either have the extensive instruments to measure and create, or the good fortune to stumble on by accident,—ever put up a really resonant and *purely resistive antenna* on *all* the bands on which we operate. True, some of us have purchased pre-tuned and resonant beams and for those there has been no problem. The beam-men are however, in the minority!

Our antennas are not cut accurately—we neglect the fractions, even the inches when we put them up. The antennas, of necessity do not clear objects which are in their fields by sufficient space; very often single-wire leadins are led close to buildings, trees and even the ground. Lastly, but not least, Ham antennas must, of necessity operate in *bands* of frequencies, and not on a single point as do the commercials. All of this bodes little good that the antenna is purely resistive by any yardstick, and it probably have a considerable reactive component as well as to fail, generally, to match the feeder line with any degree of accuracy.

Furthermore, the simplified form prevents the correct match because the taps on the inductance Lp are usually mechanically tied into the band-change switch without regard, other than just in passing, to either the antenna's nor the final RF tube's impedance. The values for capacitor C1 and C2 are chosen for matching resistive loads from, usually 50 to 750 ohms where, unfortunately, not all antennas fall. (It's always your own antenna that fails you there too, doesn't it!)

No provision is made to determine if the network is itself taking the load instead of the antenna; and the network Q is chosen low (ARRL Handbook, 34th Ed., 1957, at p. 15) for band-pass accommodation, occasionally resulting in lesser harmonic suppression. Truly, the simplified corruption is a far cry from the original Art Collins Pi-Network; and for those obvious reasons usually does not provide the same satisfactory performance.

The Pi-Network is a Purely Resistive Device

The entire concept of the Pi-Network is based on purely resistive termini. If the section is used to tune out reactances such as are found in over 90% of the Ham antennas, it no longer follows truly its resistive parameters.

As an example of how closely the Pi-Network is based on resistive termini, let us consider a transmitter with an output stage which can be operated on either (a) 1000 volts @ 200 ma input, or (b) 1000 volts @ 400 ma input. Such a rig is fairly comon as, for instance, a cw set running with reduced power for local QSOs as required by FCC Regs.

The formulae found in the 1957 Edition ARRL Handbook, at page 151 inform us that at the 200w power, for a 50-ohm line output, purely resistive load, the following is true. (See *fig 3*). So, for 1000 volts @ 200 ma input to the final rf amplifier, on 3.5 mc: Values are C1-270 mmfd; L1-8.5 μh; and C2-1,720 mmfd.

Now, by applying the same formulae for the 1000 volts @ 400 ma input to the same rig (*fig 3*), operating on 3.5 mc, we get: C1—533 mmfd; L1—4.9 μh; and C2—1,073 mmfd.

Please note that we have come up with an input capacitor (C1) which is so large as to be ungainly. This is especially true when we use A3 and have to use 2000-volt spacing in

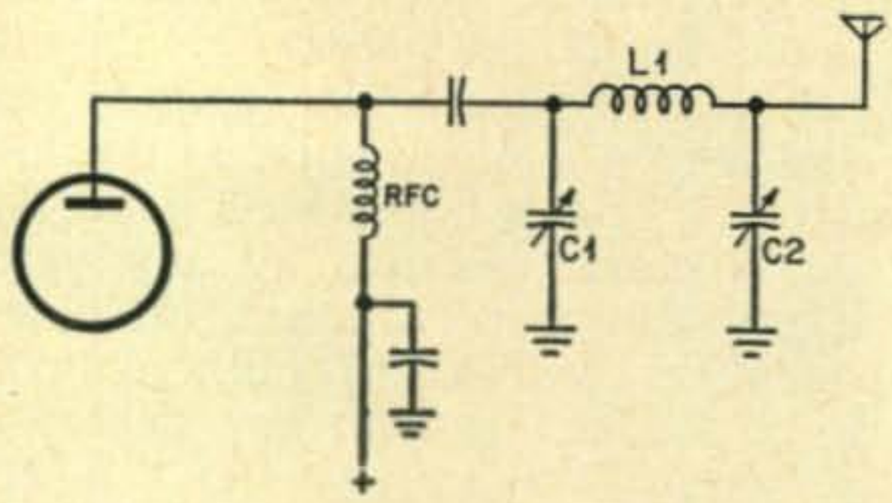


Fig 3. A Low-Power Rig, operating on 3.5MC Input to Final RF, -1000V @ 200MA

the example above. Since this involves us in this dilemma, we compromise by changing the inductance of the coil L1 until the input capacitor C1 becomes a more practical value. But by doing this, the Pi-Network no longer operates without losses and these are mounting to prohibitive levels.

From the above it can be seen that not only did one of the capacitors get larger while the other got smaller in value; the inductance was nearly halved. And all this as the result of changing only the power input, with no change in antenna, rig or tube!

What then, is the effect of using a larger inductance than we computed? What would be the effect of using the original inductance which we figured at the lower power in the rig in *fig 3?* Or suppose the antenna load is *not* purely resistive but has considerable reactance? Also what would be the result of "forcing" a load and resonance setting at the higher (400-watt) power?

Firstly, the antenna fails to take power which is being copiously produced by the rf amplifier. Yet this power must "go somewhere"! So part of it undoubtedly stays on the plate of the tube itself heating it, oft times to destruction. This is meant by exceeding the plate dissipation. Some of the power that does not get out on the antenna stays in the Pi-Network itself, where it is dissipated as heat. Is it not true that many Hams have found their polystyrene air-coils a melted blob (with that sickeningly sweet odor!); or their bakelite forms have become fire-scarred? And who among us has not had the annoyance of the capacitor arc-over? Or else the chassis (and the mike, too) becomes rf-hot with the resultant burns? These are all indications of the mismatch that is taking place, and the terrific losses due to the antenna load being both resistive *and* reactive, or the Pi-Network incorrectly designed and built for the required job.

It is obvious that these ills are not cured by changing to capacitors with greater spacing; nor will heavier gauge wire on our coils prevent most of the heating. The trouble stays as a mismatch and cannot be eliminated other than by obtaining a proper match by corrective capacitive as well as inductive values to suitable ones in keeping with established formulae, or devising a non-reactive antenna load. This last is the most difficult for the Hams.

Formulae are vexatious if one is unfamiliar with them. But they do serve their purpose in accurately foretelling what can be reasonably expected from given circuitry. Failure to observe the formulae, failure to present a purely resistive load, failure to incorporate sufficient tuning facilities, such as separate taps on network coils which are divorced from the band-change switch, are reasons why networks built as in *fig 2 or 3* work poorly if at all, develop heat; why efficiency is low; and why, in the final analysis you just don't "hook" that long-sought after DX QSO!

It should also now be clear why an antenna will load with a low powered rig, but won't with a higher powered one—on the identical frequency, with the same capacitor and inductance values in the network. This has been a stumbling block which has tripped up many an enterprising Ham. It shows that every Pi-Network must be built to work with a particular tube, at a predetermined power input, and into a definitely computed and truly resistive output which cannot be reactive. We can generally determine the tube and the power, but—worse luck—no matter how we try, unless we are lucky, or among the few, comparatively, who have beams—we definitely will not produce nor erect an antenna which together with its feed-line will present only a pure resistive load to the Pi-Network. Therein lies our trouble and our Waterloo.

Harmonic Attentuation of the Pi-Network

Now let us consider the matter of harmonics. Here again the Hams have, to put it mildly, handled the facts with some abandon. Well designed Collins Pi-Networks do suppress the harmonics; the "simplified" version is another story.

Let us assume a Q of 15 for the network, loaded, and a fundamental frequency of 4.0 mc, for simple arithmetic, tho any frequency could have been chosen with exactly the same results. Harmonic suppression is not a matter of frequency choice; it is a matter of networks and—as if you didn't know—formulae!

Let us further assume that the rig has an efficiency of 75% from an input of, say, 400 watts, thus putting out 300 watts into the antenna. According to the formula ("Reference Data for Radio Engineers," 3rd Ed. pp. 116-117)

$$\frac{E_o}{E} = -\frac{Q^2}{1 + K^2Q^2}$$

$$\left[\left(\frac{f}{f_o} - \frac{f_o}{f}\right)^2 - K^2\left(\frac{f}{f_o}\right)^2\right]\left(\quad\right)$$

(Where $K \approx 1$ for a Pi-Network and the db

response is equal to $20 \lg_{10} \frac{E}{E_o}$)

here is what would happen in the harmonic department:

2nd Harmonic: –23db, or 1.75 watts output on 8.0 mc.
3rd Harmonic: –34db, or 0.13 watts output on 12.0 mc.
4th Harmonic: –41db, or 0.011 watts (11 milliwatts) output on 16.0 mc.

For those who are interested, the Q has little to do with the suppression of harmonics. The screams of the outraged can be heard 'way to here. But remember, we are discussing harmonics far-removed from resonance. Close to resonance, Q has everything to do with selectivity.

But back to our "far-from-resonance" harmonics. If the Q is made too high, of the order of 20 or 30, the tuning becomes extremely sharp at the fundamental operating frequency with little tolerance for band-width and even less tolerance of any stray reactance in the antenna system. And we are discussing circuit Q, not the coil Q itself. This makes it imperative to hold the Q to a figure around 10 to 15 which presents good band-width operation and slightly more reactance tolerance. If, on the other hand, the Q is too low, it will be impossible to find the resonant dip as the response curve is flattened out. Again, please note the difference between the Q of the coil itself which should be as high as possible by virtue of good form factor (diameter to length)—and the *loaded*, or circuit Q figure which should be as has been stated. Formulae for both applications are found in any text book, the ARRL Handbook, etc.

Consider, now, what the harmonic suppression would have been with the identical rig, at the same power and frequency, but using the original Collins Pi-Network. We will have to have a plate tank coil, and so as not to make the comparison too rough, we'll assume a loaded plate tank Q of only 10, which is ultra-conservative. Figures between 10 and 18 are very common in the industry.

To compute the harmonic suppression of such a network and plate tank coil-capacitor combination, merely add the response of the plate tank ("Reference Data for Radio Engineers," 3rd Ed. p. 120.

$$\frac{E}{E_o} = \frac{1}{\sqrt{1 + (2Q \frac{f - f_o}{f_o})^2}}$$

where f is harmonic freq.
f_o is resonant freq.

and response is $20 \log_{10} \frac{E}{E_o}$)

to the figures previously computed for the Pi-Network alone and come up with the following:

2nd Harmonic: –23db + (–26db), or –49db, or approximately 3 milliwatts output on 8.0 mc.
3rd Harmonic: –34db + (–32db), or –66db, or approximately 1.5 *micro*watts output on 12.0 mc.
4th Harmonic: –41db + (–36db), or –77db, or approximately 0.05 *micro*watts output on 16.0 mc.

Which is quite a difference! Please note that by the Atlantic City Radio Agreement, harmonics should be held to at least –40db of the transmitted fundamental, or 200 milliwatts, whichever is less. ("Reference Data for Radio Engineers," 3rd Ed. p. 13.) That 2nd harmonic of the "corrupted," or simplified Pi-Network certainly does not meet that law, and one of these days Freddy Charlie Charlie might just not like it!

So much, then, for the Pi-Networks. What can a Ham use that is (1) Easy to Tune, (2) Matches many different antennas with suitable band width, including those with a reasonable amount of reactance, (3) Suppresses harmonics at least to the legal minimum level if not beyond, and lastly is not too expensive to construct? The following is one answer.

The Modified "Z" Network

What we are about to describe is not new —the commercials have used it for years; it has appeared in other Ham publications, like the GE News. But it seems to have been overlooked by the Hams. It is called a "Modified Z-Match" from the fact that the circuitry looks like that letter, just as the Pi-Network "looks" like the Greek letter π.

Effectively, the Modified Z Match circuit is composed of 3 elements, which are: (See *fig 4*)

(a) The parallel resonant plate coil LC.
(b) The impedance-matching link C1L1.
(c) The output auto-transformer L2.

Technically, the impedance of the tank coil LC matches the tube load. (No guess-work here, no sweat to compute it, either.) This tank is coupled to a link coil-capacitor combination L1C1 which is arbitrarily chosen with very low impedance. The link coil computations are purely empirical which makes them

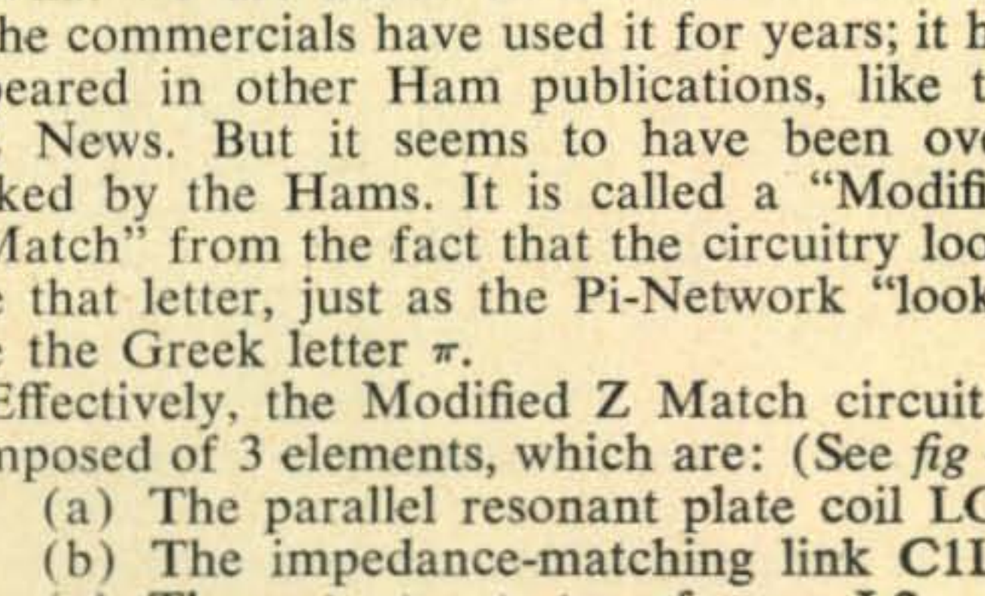


Fig 4. The "Modified Z Network"

easy to figure. The link coil is tapped into the antenna at a point which is exactly the same number of turns from its end, as there are turns in the link coil L1. That was easy! Finally, we have an antenna coil which has a self-impedance equal to the tube load, or if we prefer, some impedance which will cover nearly any type of antenna impedance. Capacitor C1 is chosen by empirical formula; is of the receiving type, hence cheap. It is used to tune out any reactance which might be part of the antenna impedance. The Modified Z Match has been used successfully to match antennas from very low impedances, say around 5 to 7 ohms to high impedances from 1000 to 2500 ohms.

For purposes of band-switching, the taps T1, T2 and T3 can be pre-set since the position of each can be fairly accurately figured from simple formulae and experiments. Tap T4 need only be set once for any particular antenna and so long as the antenna is not changed, the tap need not be changed. So there is really only one additional "control" over those of the simplified Pi-Network.

Operation of the system is as follows: First resonate the tank coil LC, next load with capacitor C1. Repeat this operation until the desired load at resonance is achieved. One word of warning. Capacitor C must *never* be to either its fullest minimum or maximum capacitance. Always allow a bit of unused capacitance to assure a true resonant point.

Finally, if no positions of either capacitors can be found at required full load resonance point, then tap T4 can be altered until such a position can be found. So unless your antenna is clear out of range of coil L2, you are assured of a match and of finding such a point.

Building the Modified Z Network

It is not possible (except with pushing your luck) to build the Modified Z Network without using the formula. We have, however, simplified these to where you won't need any calculus, nor even a slip-stick. Just use the old arithmetic and come out with some common sense.

STEP 1. Divide the final plate voltage, *under load*, by 2 times the determined plate current. Use only volts and amperes, remembering to convert your milliamperes accordingly. Label the answer Z_r, which is the tube load in ohms sufficiently accurate as to be entirely usable. Thus:

$$Z_r = \frac{\text{Plate Volts}}{2 \times \text{Plate Current (Amps)}}$$

STEP 2. Decide on the Q of your tank coil circuit. Pick a figure between 10 and 15 as conservative. It would be okay to choose the top, or 15, if you wish.

STEP 3. Using the formula below, figure an inductance L to match the lowest frequency on which you intend to operate.

$$Z_r \text{ equals } 6.28 \times f \times L \times Q$$

You know Z_r from Step 1. the letter f stands for frequency. If you express the frequency in megacycles (mc), the inductance will come out in microhenries. If you use the frequency in kilocycles (kc), the inductance will be in millihenries. If you find the formula above a trifle difficult to solve, try the one below which is exactly the same, using numbers for the letters Z_r, f and Q.

$$L \text{ equals } \frac{Z_r}{6.28 \times f \times Q}$$

STEP 4. Having found the inductance L, choose a capacitor to resonate your inductance at the same lowest frequency which you chose for Step 3, using the formula below:

$$LC \text{ equals } \frac{25{,}330.}{f^2}$$

Tough? Try the one following which is exactly the same.

$$C \text{ equals } \frac{25{,}330.}{f \times f \times L}$$

Be sure to use f in megacycles (mc) and L in microhenries (μH), then the capacitance C will come out in micromicrofarads (mmfd).

STEP 5. You now know your inductance and your capacitance. Pick a capacitor from any catalog or jobber's shelf (or your "hellbox") with a breakdown voltage of 2 times the plate voltage if you operate on fone, 1 times the voltage if cw, only. Also choose one with slightly more capacitance than what you figured as well as as small a minimum capacity possible so as to "hit" the high ends of the bands of your choice.

STEP 6. To wind the inductance, use the formula below, choosing a radius which will give you a good "form factor" (2 times radius in inches to length in inches) lying between the figures of 1 to 1 and 1 to 3½. You may also use any of the many coil charts available from ARRL, and such firms as Air-Dux, Barker & Williamson, Bud Radio, etc. Following is the formula: (Derived from formula on p. 27, ARRL Handbook, 34th Ed., 1957.)

$$N_L = \sqrt{\frac{6r + 9b}{0.2\,(2r)^2}} \times L$$

Where r is the radius in inches of the inductance;
b is the approximate length in inches (or the space available in which to wind the coil);
N_L is the number of turns; and
L is the inductance in microhenries.

Example: An inductance of 8 microhenries

is required. The coil form is ½" in radius, and approximately 2 inches are available as winding space. Then r = ½, b = 2, L = 8.

$$N_L = \sqrt{\frac{(6 \times ½) + (9 \times 2)}{0.2(2 \times ½)^2}} \times 8 =$$

$$\sqrt{\frac{21}{0.2}} \times 8 = \sqrt{840} = 29.1$$

Therefore 30 turns would be close enough. Next divide the number of turns into the length of the coil to determine if proper size wire will fit. Compare the answer to the diameter of the wire taken from any wire table. Use the following general wire sizes as conservative smallest sizes for the powers indicated; but use larger sizes if possible at all times:

10 watts, use AWG No. 20, bare or enamelled,
25 watts, use AWG No. 18, bare or enamelled.
50 watts, use AWG No. 16, bare or enamelled.
100 watts, use AWG No. 14, bare or enamelled.
250 watts, use AWG No. 10, bare or enamelled.
500 watts, use AWG No. 8, bare or enamelled.
1 KW, use copper (or silver) strap or ¼-inch tubing.

Example: using the answer above, length equals 2 inches, number of turns is 30. Divide 2 inches by 30 turns getting 0.066 inches. From the wire tables, the largest wire diameter with a little space between wires (you never can wind them perfectly) would be AWG No. 14 enamelled. That would nicely handle 100 watts.

However, suppose that your rig runs a "half-gallon." Required is AWG No. 8 wire with a diameter of 0.128 inches which would not fit. So you would have to re-design the coil trying a larger diameter. If you would try a 3-inch diameter coil, making it 4 inches long, you would find that the total turns for 8 microhenries inductance would come out to 24 turns. Dividing 4 inches by 24 turns gives you a "pitch" of 0.166" which will permit you to use AWG No. 8 wire with a little spacing between turns.

In any event, we now have our coil and capacitor for the tank.

STEP 7. For inductance L1, we shall use the same size wire as we did for the plate tank coil. We shall wind this *over* the cold end, or "ground" end of inductance L and shall use approximately 10% of the number of turns of coil L, give a turn or take a turn. The only exception would be as follows: If the total turns are 40 or less in number, then the inductance L1 will be:

For Total Turns in L.	Make L1 with these turns.
40-25	5
24-15	4
14-10	3
9- 5	2
5-down	1 (full).

STEP 8. Choosing capacitor C1 is easy. Get one with a value of about 400 mmfd with correct receiver spacing which should be good to a "full gallon." If you can't get a single unit with 400 mmfd, take a double 220-220 mmfd. receiver type which will fill the bill nicely.

STEP 9. You may either compute the antenna inductance, or you may make it exactly like the plate tank coil, or, you may use a "rule of thumb." All three will work equally well, tho the tank coil duplicate will handle the lowest impedance of the three.

If you would compute your coil, choose, a round, somewhat high, figure as your antenna matching impedance and apply the formula below:

Z_A equals $6.28 \times f \times L_2$

where Z_A is an ohms, f is in megacycles for the lowest operating frequency you will use, and L is in microhenries. You can also use this formula which is exactly the same:

$$L_2 \text{ equals } \frac{6.28 \times f}{Z_A}$$

In this instance, it is suggested that you choose an antenna impedance somewheres around 1300-2000 ohms.

The second method is to take the inductance found in Step 3 and to multiply the figure (in microhenries) by the Q of that coil as you chose it in the first instance (Step 2).

Regardless of the method you employ, build it exactly with the same formula that you used for the plate tank inductance L, using the same wire size and spacing. Naturally, and except if you duplicate the tank coil, the length will be longer than the plate tank coil.

The tap T3 position is found by taking exactly the same number of turns from the ground end of the coil as there are in the link inductance L1.

STEP 10. To find the intermediate tap positions for taps T1, T2 and T3 for band-switching, repeat Steps 3 thru 6, changing only the frequency f in each instance. Or else you may use the trusty Grid-Dipper to find the positions for the lowest frequency in each band to be served. Do not change the Q, Z_r or the coil diameters in your calculations. Note that the shorting is done from the "Hot" end, and that if more than one tap is used, *each* tap *must* be shorted to the previous tap so as to break up the unused portions of the inductances into small parts which do not resonate to any harmonics, etc. This is usually done with a sequentially-shorting band switch such as is sold by Oak, Centralab or Mallory, etc.

Now connect up the network.

Harmonic Suppression with the Z-Match

For those who might be interested, the following is the computed harmonic response of the Modified Z network: ("Reference Data

[*Continued on page 178*]

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Console

Overall view is very pleasant to look at.

The idea for the console and its subsequent construction, is the result of loose talk at a bull session. The ham shack occupies one half of a 20′ x 30′ garage, so I was toying with the idea of isolating the shack from the garage and building a table in the corner for the equipment. W5TNT (Carswell AFB in B-36's) asked, "Why not a Console? Why, we built one at K5FAT with a dull saw and a machinist's hammer." Sticking my neck out, I opined that since I had a sharp saw, a framing square and a hand plane with a fair edge, I could do the same, and a heck of a sight better. The faint-hearted and mail order hams can stop here. This is not for them.

Construction

The shack was measured off and paneled in knotty pine. This console was built as follows:

Required:

A small amount of cash; a little grease (elbow type); and (a) patience, or (b) a used lead bullet (for biting), or (c) moderate skill at carpentry. "C" is faster.

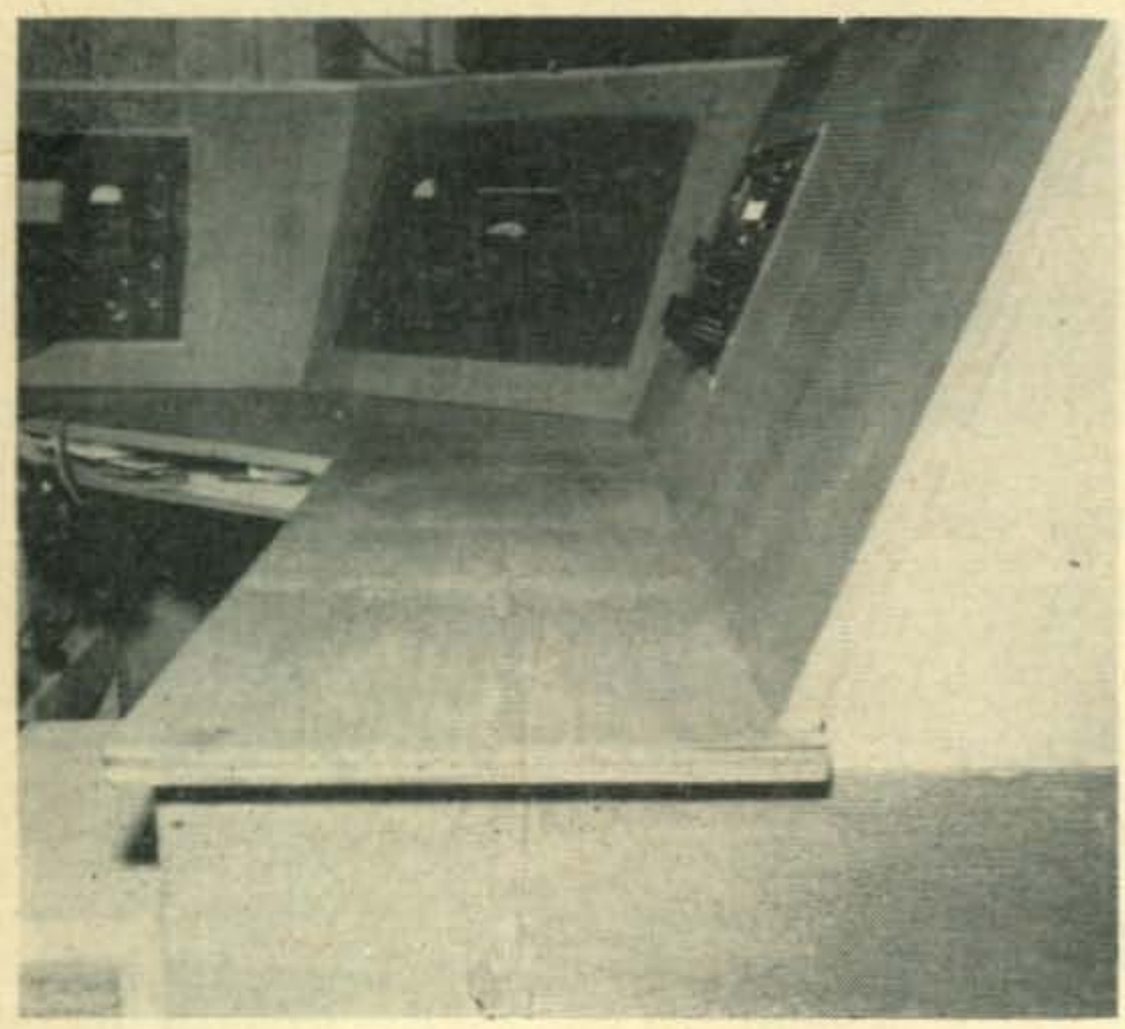
Other necessary equipment: A good hand saw, a two-foot carpenter's level, a framing and tri-square with adjustable angle, a small hand plane and plenty of sandpaper. A hand drill is welcome as screws are used where suitable. Nails are a wood-splitting hazard.

If you'd like to build a console like the one shown here, review the diagram and begin by deciding what height is best suited to your build. Twenty-nine inches from floor to finished top was used at W4RJ.

Three-quarter inch plywood was used for the top surfaces with 2″ x 2″ framing. Your floor may not be level (mine wasn't) so the carpenters' level will come in handy to avoid transmitting this defect to the console.

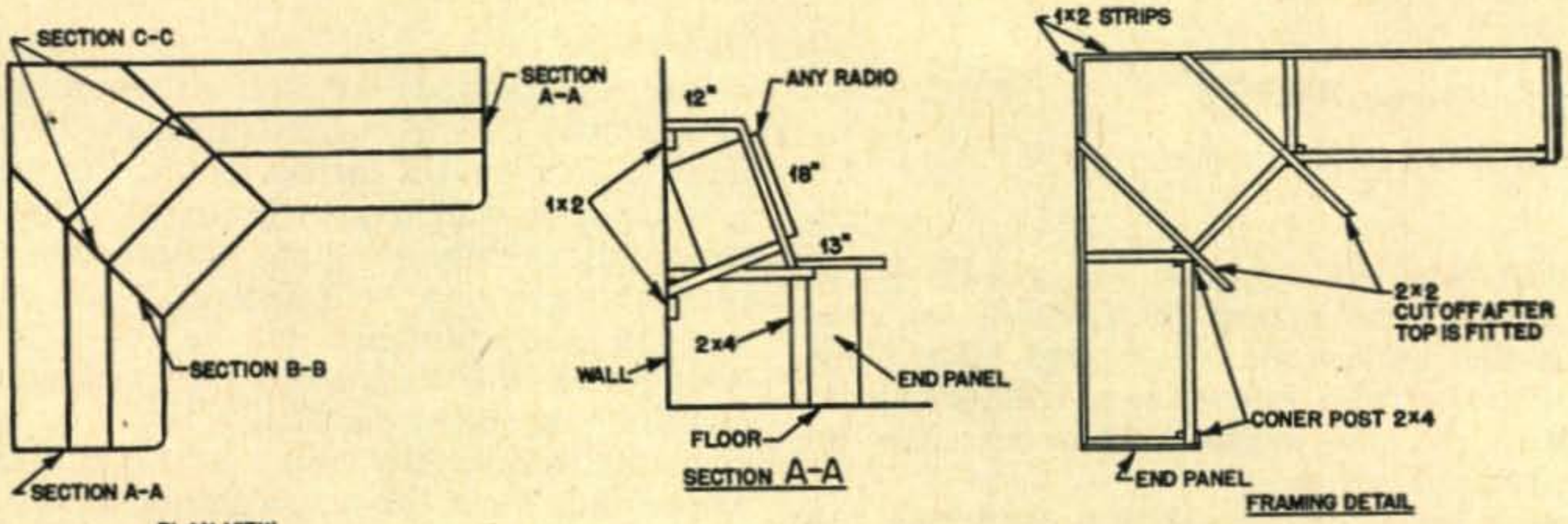
If economy is a factor you should check with your local cabinet making shops and pick out various odd sizes of boards and panels which, being less than full sized, you can haggle over for a cut in the regular price. Plywood was no problem for me, but the rift oak called for shopping. Use at least ¾″ plywood for the top, heavier will be even better, if you can afford it.

After the supporting frame is finished, frame the support for the slant front, using 1″ x 2″ material. The plan can be scaled and these pre-cut, adjusting the tri-square to the angle on the plans for the bevel where the vertical pieces meet the horizontal. A strip is used to support the top, keeping it parallel to bottom strip. After finishing the rough slant support you can begin putting on the finishing touches.



Interlapping of parts is clearly shown in this view

Here is where we used the local cabinet shop. The slant panels were leaned against the supports, the finished operating top being placed underneath, and the height of the edge above table top measured. Have your cabinet shop cut this amount off the opposite edge, top and bottom, to form a mitre (see sketch B-B). Put the 18 x 25 operating position in place and secure with #6 finishing nails, using a nail set. All such holes may be filled later with plastic wood. Measure the distance from each corner of the operating position top to a framing square laid against outer edge and at right angles to wall. Use these measurements to lay off the angle cut on each top which joins the operating position as shown. The plans show a diagonal cut starting 12" from one end and



Framing detail for a complete corner Console is shown above.

going to the opposite corner. Slight miscalculations may vary this, so it is better to measure on the actual structure to get a good fit.

Our most difficult fit was where the slant panels meet in center. We cut ours by measuring 3" from the end on each mating panel and running a line with a square to the corner. Measure and mark as many of these pieces at one time as is feasible and have the cabinet shop cut them all at once (cheaper that way).

We laid off the openings for the 32V3, 75A2 and 310B and had them started with a Skil saw, while the other cuts were being made. They were finished with a hand saw and sanded. If you plan carefully, one trip to the pro will suffice. Once all cuts are made, lean the finished panels against rough supports and try them for fit. If everything is well, fasten the center section in place with wood screws, drilling and countersinking, to fasten to your framing. Work outward to the ends. Any discrepancies in measurement can be corrected at the ends as these panels should have been left a little long. Use your hand saw to cut them off to size. A plywood panel of the size noted is used to finish each end and help support the top. We had a piece left over, which we used on the left front, cutting out openings with a Skil saw for four drawers. The cabinet shop made the drawers and slides, and cut the rectangular openings. Slides for the equipment are made of 1" x 4" pieces with 1" x 2" pieces screwed to one edge. The fronts of these were fastened to the slant panels with 1½" #6 wood screws, countersunk, three screws per slide. Measure the length of these approximately, cut them slightly long and fit in place, using the nailed strip to support the rear against the shack wall.

Advantage was taken of the space under the operating position. A piece of ¼" plywood—or sheet aluminum—is used to form a spot for log book, pencils and such. Having still another piece of plywood left, a support for a typewriter was put on the right end and was supported on its outboard end with floor flanges and a 1" pipe. A space similar to that under the operating position was made for stationery. Finishing is optional, but wood filler followed by two coats of dull varnish were used here, each coat being well sanded and then polished with steel wool. Be sure to brush away all remaining wool.

Small stands for ash trays, beer cans, etc., shown in photo were made from the pieces of wood cut out for the gear. The support is 1" pipe with floor flanges. Wiring is matter of operating habits, personal taste and the equip-

[*Continued on page 176*]

a Tester for Glow Tubes, Selenium Rectifiers, and Germanium Rectifiers

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A glow tube is a cold-cathode, gas discharge tube in which no means is provided for controlling the unidirectional current flow. This type of tube is also known as a voltage-regulator (VR) tube, a name which describes its principal application.

A glow tube consists of two electrodes, an anode and a cold cathode, in a partial atmosphere of inert gas. The emission is obtained from the cold cathode by a potential gradient at the cathode coated surface. This gradient literally pulls electrons out of the cathode coating.

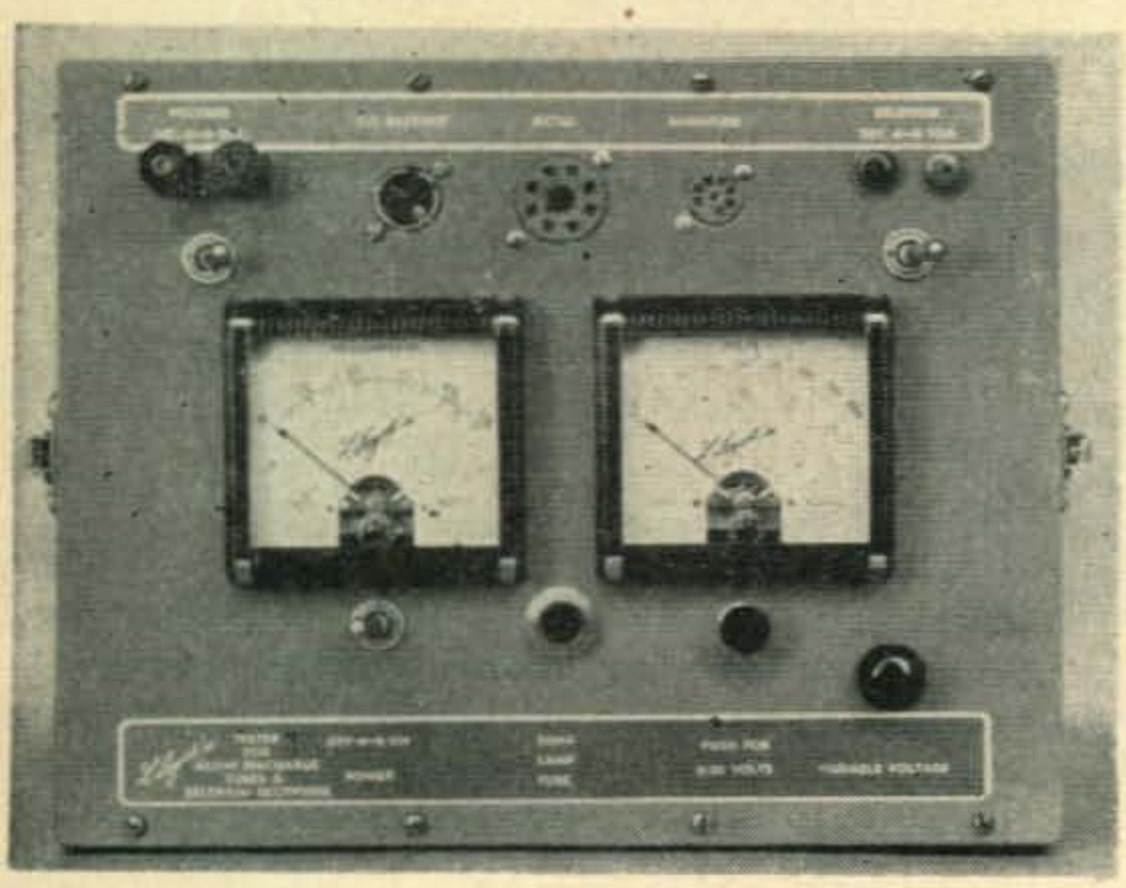
Two types of discharge are possible in a glow tube. A glow discharge, which is a uniform glow covering all or part of the cathode, (inner wire in VR types), will occur when the current carried by the tube is low. Under this condition the tube will operate normally. It is interesting to note that the voltage drop across the tube depends upon the spacing between the anode and cathode as well as upon the type of gas used. If the current through the tube is increased beyond a certain point, the tube will go into a so called arc discharge. Under this condition a cathode spot, rather than a uniform cathode glow, will appear on the cathode, and the tube drop then will be about 10 to 20 volts instead of the intended higher value. The condition of an arc discharge should be avoided since this will usually ruin a tube if it is allowed to continue even for a few minutes.

The tester to be described herein will test OA3/VR75, OB3/VR90, OC3/VR105, OD3/-VR150, 874, 1265, 1266, 5787, 6073, 6074, 1B46, 1B47, 991, 5651, 5783, 6213, NE16, NE32, VXR130, and any other glow tube that is designed to regulate up to 200 volts.

The need for a tester of this kind was first recognized at the Radiation Lab, MIT, in 1942, when it was found that glow tubes were not always interchangeable in certain circuits. At that time a tester was used similar to the one to be described herein, and many research people were amazed to find that some tubes would have such peculiarities and vary to such wide excursions from the manufacturers' published data.

Some of the more pronounced characteristics that were found to exist, and are typical, came from notes taken by the writer in 1952 while going through a box of 140 glow tubes which were taken out of service at one of the large television stations in Los Angeles. Out of the 140 discarded tubes, only 27 were found to be bad. The other 113 were put back in stock. A few of the 27 bad tubes would vary from 145 to 180 volts at 5 to 40 ma. Two would regulate within 4 volts at 5 to 40 ma but at 168 to 172 volts instead of around 150 volts. It is common to find excellent glow tubes within 4 volts at 5 to 40 ma that will regulate around 145 volts up to 160 volts. There are many circuits that will not tolerate these extremes. Five of the 27 tubes had a 'glitch' or step of 2 to 4 volts in the range of 10 to 20 ma where

Front view of checker.



the tubes are usually operated and could cause the regulated output to jump or jitter by that voltage. This is a common fault, and it is imperative that one of these does not get into a VFO or other critical circuit or regulated power supply. It should be pointed out that this change cannot be detected visually. Just because a glow tube 'glows' is no criteria that the tube is good, nor, when a glow tube flickers, it does NOT mean that the tube is bad. Flutter is usually caused by the sudden change in the flow of electrons seeking a cooler or lower resistance path in the gas contained within the tube. It should also be pointed out that flutter often can be caused by an oscillation[1] when a condenser is placed across the glow tube causing it to flutter at some low frequency visible to the eye. Of course a scope must be used to check for oscillation in the form of a saw tooth at any frequency. In general it can be said that all the DC filtering should be done ahead of the series resistor that drops the voltage so that the voltage and current through any particular tube will be within its ratings. For the benefit of some new-comers to this field of electronics, note that although a glow tube has the ability to regulate voltage, it does NOT store energy and does NOT supplant filter condensers, even though it can smooth out pulsating DC fairly well. Starting voltages vary quite a few volts depending on the age of a tube as well as on the type of tube. Some tubes will start to glow within 2 volts of the regulating voltage; others may start to glow at 10 to 25 volts above their regulating voltage.

Although neon lamps such as the 991, NE16, or NE32 have been used as regulators in low current applications, they should not be used where good regulation is desired. These tubes have the bayonet bases and therefore can be removed from the socket and turned 180 degrees and put back in the socket. (One of these lamps in service can be measured and found to be regulating at about 50 volts, then after removing it, turning it 180 degrees, and then plugging it back into the socket, the voltage now may be as high as 75 volts. After a few moments it will return to somewhere near the prior voltage. This change is due probably to a polarizing effect of the electrodes within the lamp.)

The box chart shows many of the more popular types of glow tubes with their nominal operating voltages. Manufacturers' data for voltage variation at 5 to 30 ma and/or 5 to 40 ma, or less, is shown.

A. Perfect OC3/VR105. Usually one out of ten new tubes will not vary more than 2 volts. Other types will be considerably poorer regulators.

B. 103 to 110 volts, a poor regulator; should be discarded.

C. 107.5 to 112.5 volts; could be usable except for 'glitch' at about 15 ma. Not uncommon.

Tube Reference Table

Tube Type	Nominal Voltage	Volts 5/30MA	Volts 5/40MA
OA2	150	2	6
OA3	75	3	5
OB2	105	1	4
OB3	90	4	—
OC3	105	1	2
OD3	150	2	4
874	90	—	8
1265	90	4	—
1266	70	—	6
5787	100	6	—
6073	150	2	6
6074	105	1	4
1B46	82	3 volts 1 to 2 mills.	
1B47	90	3 volts 1 to 2 mills.	
991	48/67	7 volts ½ to 2 mills.	
5651	82/92	3 volts 1½ to 3½ mills.	
5783	82/92	3 volts 1½ to 3½ mills.	
6213	130	2 volts 1 to 2½ mills.	
NE16	50/65	7 volts ½ to 2 mills.	
VXR130	130	3 volts 1 to 2½ mills.	

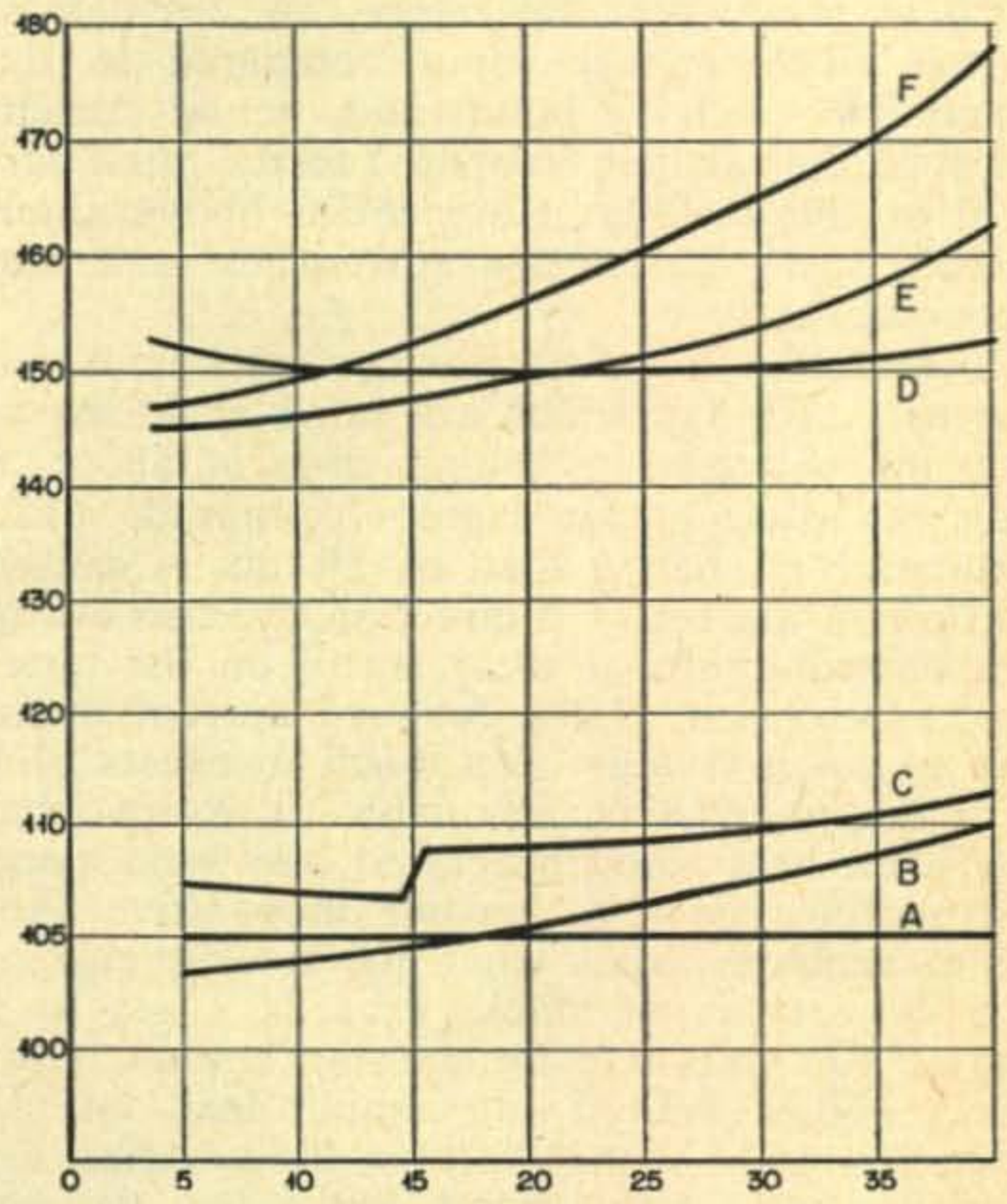


Fig 1 shows some typical curves encountered when checking glow tubes.

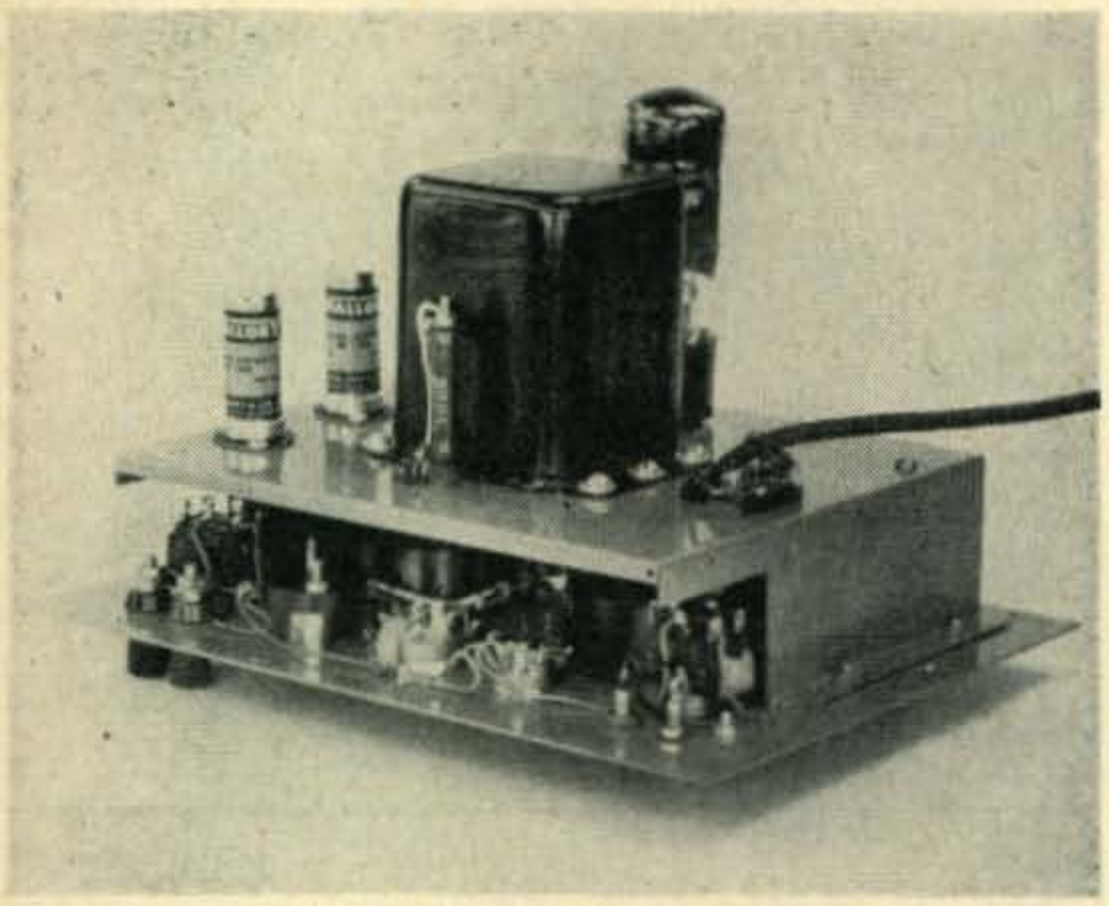
D. Very good OD3/VR150. (Some start to increase at 5 ma through 40 ma instead of curve shown.)

E. Typical curve of any glow tube no longer usable for good regulation.

F. Typical curve of any glow tube completely unusable.

Selenium rectifiers of the 130 and 160 volt stacks are now being used in more applications than ever before.

Selenium rectifiers will give extremely long and trouble-free service provided that they are operated so that the temperature will never



View of checker resting on its face.

exceed approximately 50 degrees centigrade (122 degrees F). There are many factors that will determine the temperature in actual use, such as, ambient temperature, air circulation, actual RMS voltage input compared to the rated RMS voltage input, and, actual current through the rectifier compared to the rated current of the rectifier. Frequencies above about 1 KC cause the reverse current to raise and generate heat.

Since most of the selenium rectifier stacks on the market today which are rated at 50 ma to 500 ma will have a voltage drop of about .8 volt per plate at 50 degrees centigrade (122 degrees F) when a load of 50 ma is caused to flow in the forward direction, we can evaluate the condition of these stacks on the tester to be described. If the forward current of 50 ma causes a voltage drop much in excess of 1 volt per plate, it is reasonable to assume that the extra heat being generated may soon cause the rectifier stack to become inoperative. Another problem arises when the reverse current for these types of stacks exceeds 3 ma to 5 ma at 100 volts d.c. for the entire stack. Currents higher than 5 ma should lead one to expect trouble soon.[2] After a little testing experience with a few good and a few defunct stacks, it will be obvious that the stacks can be quickly classified as 'good', 'questionable', and 'bad'.

One word of caution regarding selenium rectifiers. According to doctors' advice, selenium dioxide and the fumes from overheated selenium rectifiers have a very toxic and dangerous effect on skin or lungs.[3]

Germanium Crystal Diodes also may be tested very easily on this tester. As an example, 1N34, 1N66, 1N48, 1N51, and some other general purpose diodes are rated at 50 ma maximum forward d-c current and 500 micro amperes (.5 ma) maximum reverse d-c current at 50 volts. Most of the data sheets include the fact that at 5 ma the forward voltage drop should be 1 volt for the above mentioned diodes. Other maximum d-c forward and reverse currents for diodes may be checked from the various handbooks or from the manufacturers' data sheets.

Many other capabilities of this tester come to mind and are being used at television and radio stations and government research installations, such as forming electrolytic condensers which have had a long period on the shelf prior to being placed in service, checking and adjusting the pull-in and drop-out voltage of relays, acting as an auxiliary variable voltage power supply, and as an emergency continuity meter, etc.

The tests which have been described may be made with a simple tester consisting of a variable voltage power supply, a suitable voltmeter and milliameter. The voltmeter is a 1 ma meter with multipliers to give a full scale reading of 200 volts with the push button switch in the normal position and 20 volts in the pushed position. The 20 volt scale is used when testing selenium rectifiers or germanium diodes. A 60 ma lamp is used as a fuse to protect the 50 ma meter against accidental overloads.

In *Fig. 2*, the circuit shown was used in the first tester built in 1942 using a 6SN7 instead of the 6AS7. 6SN7 tubes are not capable of giving long service however, and should not be used. This circuit was chosen as being the most desirable from the standpoint of not generating heat and wasting power. It is a grid controlled rectifier and rectifies only the voltage desired. The regulation is adequate for this service. The bias to control the 6AS7 is rectified by two small selenium rectifiers and filtered by C2.

SW2 is thrown to the EXT position only when it is desired to use the power for some other purpose. SW2 is normally left in the INT position. For testing selenium rectifiers and germanium diodes, SW3 is used in reversing the polarity to measure the reverse and forward currents. (FOR.-REV.) A pair of test leads 2' long should be made up with one lead red and the other black. Each lead should have a phone tip plug on one end and an insulated alligator clip on the other. The three sockets shown are d-c bayonet, octal and 7 pin miniature.

Although the case was made especially for this model, any case or chassis with front panel may be used. There is nothing critical about the placement of parts. For the best possible accuracy it is essential that 1% resistors for R3 and R4 be used.

Operating Instructions (VR Tubes)

When operating this tester, do not let the voltage exceed 200 volts. When the green lamp lights up, it is a visual warning that 50 milliamperes is being approached and should not be exceeded.

Turn VARIABLE VOLTAGE knob counter-clockwise for zero voltage before tubes are plugged into or removed from their sockets.

Turn POWER switch ON. (The voltmeter will

read a few volts negative. This is normal.)

Plug the tube to be tested into the appropriate socket.

Turn VARIABLE VOLTAGE knob clockwise until the voltmeter is at the voltage of the tube under test and continue on until the tube starts to conduct. A reading will be noticed on the milliameter and a glow within the tube. Turn the knob up to the maximum current shown on the chart for the tube being tested. Two columns are shown on the chart—one for 5/30 ma and another for 5/40 ma. Assuming you are testing one of the tubes shown in the 5/40 ma column, set the current at 40 ma and note the voltage. Reduce the current to 30 ma and note the voltage. Reduce the current to 5 ma and note the voltage. (Most tubes will tend to oscillate between 0 and 5 ma, which is normal. NEVER EXCEED THE RATED MAXIMUM CURRENT: this is liable to damage the tube.) If the voltage changes are within those on the chart, the tube is probably good. To make sure, rotate the knob slowly and cause the current to vary from 5 to 40 ma and look for any sudden changes in voltage. There should not be any sudden changes, but you will note that the voltage of some tubes will be slightly less at about 15 ma than at 5 or 30 ma. This condition is normal. If you have reason to believe the tube is giving trouble, set the current at about 30 ma and let it run for several minutes and then recheck. Some tubes, especially the 105 volt types, will be found to regulate extremely well and a change of 1 volt from 5 to 40 ma is common.

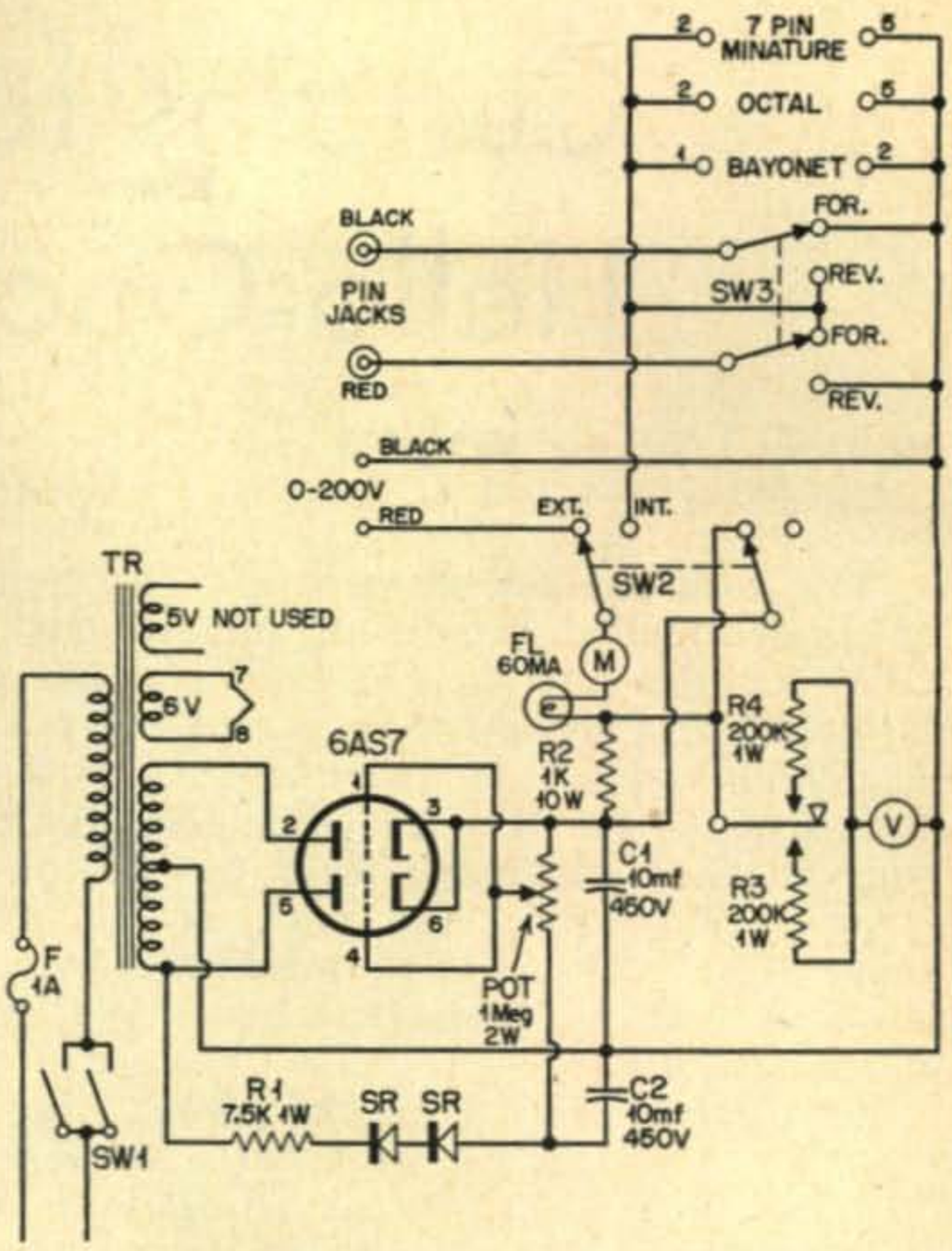


Fig 2. Checker Schematic

Selenium Rectifiers

Turn VARIABLE VOLTAGE knob counter-clockwise for minimum voltage.

Turn POWER switch ON. (The voltmeter will read a few volts negative. This is normal.)

Plug the color coded pin tips into the correct pin jacks marked SELENIUM.

Connect the red alligator clip to the plus lead of the selenium rectifier. Connect the black alligator clip to the negative lead of the selenium rectifier.

Set the SELENIUM switch SW3 to REV. (Reverse) current.

Turn VARIABLE VOLTAGE knob clockwise for 100 volts. (Do not leave the voltage on for more than a few minutes. Just leave it long enough to take the reading.)

The current should not exceed 5 ma for a fair unit—.1 to 2 ma being a "good" reverse current.

Throw the SELENIUM switch SW3 FOR. (Forward current.)

Set the VARIABLE VOLTAGE knob so that 50 ma is shown on the milliameter.

The voltmeter should show less than 20 volts. If less than 20 volts is indicated, press the button PB. Note the reading. It should be 1 volt or less per plate in the selenium stack. Anything over 1 volt per plate in the selenium stack is an indication that the stack is not in good condition. When the voltage drop exceeds 1.5 volts per plate, the stack should be discarded and a new one used. Hold PB down for a minute to check for a voltage increase. Some units that are damaged or defective will start to creep up in voltage after a few seconds and should be discarded if the voltage exceeds 1.5 volts per plate.

Germanium Diodes

Follow the same instructions for testing Germanium Diodes as you would for Selenium Rectifiers, except that the Forward and Reverse currents and voltages should conform to the manufacturers' data sheets for any particular type of diode. Heat due to excessive current or heat from a soldering iron may damage or ruin germanium diodes.

This tester will prove to be of great value in the operation of commercial equipment. Too often trouble develops in VR tubes, selenium rectifiers or germanium diodes, and the engineer trying to find the trouble would know immediately if it involved these components by making a quick test with this tester. ■

References:

Proceedings of the I.R.E. Sept 1950 p 1093, 12.3 "Cold-Cathode and Voltage-Regulator Tubes".

1 See CQ Apr 1955, p. 17, "OB2 Oscillator". GE tube data sheets recommend that any condenser across a VR tube should not exceed .1 MFD.

2 A very fine, comprehensive report on Selenium Rectifiers appears in Radio and Television News, Oct 1952, p 66.

3 See Consumers' Research Bulletin, Oct 1952, p 26.

Curtains for the Hello-Goodbye QSO

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"Our firm handles all sales and distribution of Encyclopedia Britannica publications in Latin America and the Far East. . . . We are in receipt of a request from one of our clients . . . published by your company." This letter from BARSA PUBLICATIONS, INC., of Los Angeles, Cal., meant the word was out about HAM REGISTER. And, this is the story about HAM REGISTER, conceived by one of our well known hams, Art Lewis, W3VKD, of Indiana, Pa.

HAM REGISTER is off the press . . . available this month. It's a whale of a book. Approximately 500 pages containing little bits of intimate personal details on approximately 10,000 hams in United States, Canada, and more than 100 DX Countries all over the world. Did you have time to find out that John, CR9AH, is Chief Engineer of the local broadcast station in Macau? That he attended primary schools in San Francisco, Cal.? Or did you know that Loyd, W7BA, a guy who has made BPL for five consecutive years, is Vice-President of an insurance firm in Seattle, Wash.? How about Bob, K2EGI, a radio op on TWA international flights. Did you know that in 1951-1952 he was SU1AD? This is just an inkling of the many bits of interesting information to be found in HAM REGISTER on most of the more active hams the world over.

The rear section of HAM REGISTER contains a cross-index. This little gem is worth its weight in gold. If you're travelling through the state of Missouri, for example, whether on business or pleasure, with or without ham radio, you will find that this cross-index gives you the call letters of every amateur listed in H-R under the name of every city or town in the "Show-Me" state. Similar call letter listings are included in the cross-index for each of the 48 states in the USA and for each country of the world. Now, for the first time, those of us who travel around a bit may while away a pleasant evening or two in distant cities with personal calls on our "on-the-air" friends. Somehow, you just can't find W3VKD in the telephone directory. Overseas amateurs will find the cross-index very helpful in locating active W hams in each of the 48 states for WAS.

Haven't all of us, at one time or another, dreamt of installing a blivot pin on a phranistan to come up with a better mouse trap? But how often do we take the initiative to follow through? Like so many of us, Art had an idea. He felt there was an urgent need for some medium to lift our QSO's above the level of, "Hello—Report—73 BCNU". The idea of some kind of a listing of hams showing their occupations and pursuits was kicking around in the old grey matter for a long time. Two years ago, W3VKD, his wife, Dot, and daughter, Carol vacationed among 24 countries in the Caribbean, Central, and South America. They visited many of the hams whom Art had contacted regularly over the years. He was deeply impressed by the interest those hams expressed in the U.S. radio amateur. It was apparent that all hams would be just as interested in the occupations and experiences of other hams, both local and overseas.

One ham said he didn't want to get on phone because, "after I have talked about the rig, I don't know what to say." Some of us are more reluctant than others to ask leading questions about the other fellow's way of life. HAM REGISTER contains plenty of information in this respect. There are lawyers, bankers, doctors, merchants, musicians, plumbers, electricians, editors, bakers, builders, engineers, clerks, writers, scientists, soldiers, sailors, artists, missionaries, technicians, a National Tennis champion, a TV actress, and, yes, even an Indian Chief. A glance over the various occupations will quickly dispel the myth that amateur radio is primarily the hobby of those engaged in electronic pursuits.

Convinced that his idea was a good one, Art rolled up his sleeves and went to work. If you've noticed his scores in DX contests, etc. you know that he is all business about anything he tackles. Much consultation with the experts and sifting of suggestions resulted in the preparation of a questionnaire for mailing to develop a minimum amount of information. Cracking the market with a new publication isn't the easiest thing in the world to do. A miscalculation can be very costly! It was decided, therefore, to sample the market. A list of hams who were DX'ers, Ham Authors, winning contestants, traffic men, phone men, rag chewers and old timers was compiled. Their response to the questionnaire was overwhelmingly favorable. Encouraged by this response W3VKD committed himself to the venture. An office blossomed forth with 4 girls to help out. Hundreds of questionnaires left Indiana, Pa. daily. Each incoming mail brought hundreds of replies. Most contained words of encouragement, such as "Such a book long

overdue", "This should really be an aid to ham radio. Glad to see someone finally doing it.", "I like your idea, I believe it could bring around the good feeling we had about ham radio in the early days when you knew more about your radio friends." Ham Register fulfills this latter comment. It contains a wealth of information about the ham's education, his first license date and call even back to the days when you just picked your own call. Where's the old spark coil gang? Many of them appear in Ham Register's pages. In addition to the usual QTH information there is a multitude of listings concerning the ham's social and business organization, clubs, fraternal organizations—orders, etc. But most heartwarming of all, many returned their questionnaires saying, "Reserve a copy for me. Bill me when publication available for delivery." And this before a price had been established. And so began the long arduous task of compilation with plenty of help of course. Developing format, trips to the printer. Worry because the print schedule was getting too far behind. Then worry because the printer began to crowd dangerously close for copy. Saturdays-Sundays-nights, weekends. Routine . . . blurry eyed . . . dogtired. Poor old Art even lost his taste for working DX for awhile. That's when the XYL, Dot, put her foot down. She knew that when W3VKD stopped DXing she'd have a sick man on her hands. So she pitched into the battle, too. Between them, with regulated schedule of hours, they surmounted the Herculean mass of details imposed by the many listings.

But the routine was not without humor. There was the ham who said his special achievement in ham radio was a Q-5 (Pink QSL) in 1938 from Grand Island, Nebraska (FCC). Then there was the ham who in regard to his family status, answered wryly, "I'm the head of my household on Monday, Tuesday, Wednesday and Thursday. On Friday I come back home." Another fellow fluffed off his occupation as "an unemployed quiz contestant". And there's the old timer who said that he used to run pretty high power in the good old days, but had to bury his spark transmitter five feet underground so his neighbors could get some sleep. (That was just before TV, of course.) But the payoff was the complaint from the poor soul who couldn't understand why he didn't win the CQ-DX Contest. With a straight face (pen) he said, "I called CQDX more times than anybody." Then there is the fellow with the spark transmitter that could be heard out the window as far as it could be heard over the air. Best DX was 16 miles. With this information to go on imagine how much more interesting QSO's can be.

On the serious side HAM REGISTER is living evidence that amateur radio has contributed much to the welfare of the world. There are many interesting comments among the listing of accomplishments. There's the G station who made the first trans-Atlantic contact between Europe and North America. Also the ham who was one of a party of three to rescue the late Admiral Richard E. Byrd, when the latter was overcome by fumes at his solitary South Pole observation base in 1936. There's a noted concert singer who can sing in five different languages. Many are the remarks of electronic development and advancement of the art of radio communications.

Most of the hue and cry has subsided, but the light burns late into the night in the office where HAM REGISTER was born. And already the second edition is being formulated New listings will be included, and those received too late for the first edition will be added. If used as intended, Ham Register should add greatly to our enjoyment of the hobby of ham radio. It should make us new and firmer friends. This list of names can be the basis for many an interesting discussion. List of names? No, more than names. People—Hams . . . you and me. Hams from everywhere, and in every station of life . . . interesting people . . . fascinating pursuits. A story of an accomplishment and a piece meal history of the development of the radio amateur. But even more impressive, Ham Register demonstrates the fact that amateur radio develops real men and women.

Who is this Art Lewis that set this goal for himself? His own Ham Register gives the following listing about its editor . . .

W3VKD . . . Arthur E. Lewis, RD#2, Indiana, Pa. . . . Art, Age 50 . . . Licensed 1927—W8CNZ advanced . . . Ex radio engineer on WJAS, WMMN, WTAX, WOC, KMLB, WROK . . . In Retail Merchandising business—est. 1939 . . . College: University of Pittsburgh BS—'35 . . . Clubs: PP Indiana County ARC, Honorary Member Frankford RC, Bellowers and Chirpers Soc., Radio Officer for Indiana County CD . . . Family: Wife, Dorothy, Son, Roy, Daughter, Carol . . . Hobbies: Travel and Photo . . . W39Z, CPC35, DXCC-200, WAS, WAC, WAA, CAA, etc., Winner for W Pa in SS, VE, VK/ZL and various DX contests . . . Won trip around the World via PAA in National Sales Contest . . . Every day is a ne wthrill in operating . . . Friends met through ham radio have been valuable business and social contacts . . . Most interesting experience: "Ham Vacation ala W3VKD"—(QST Aug '56)—toured 24 countries in the Caribbean, Central and South America visiting hams met over the air before. Operated from 21 countries four of which were during the DX contest. Made 4000 QSO's during the trip. Sent QSL to all.

Super-Gainer CW Receiver

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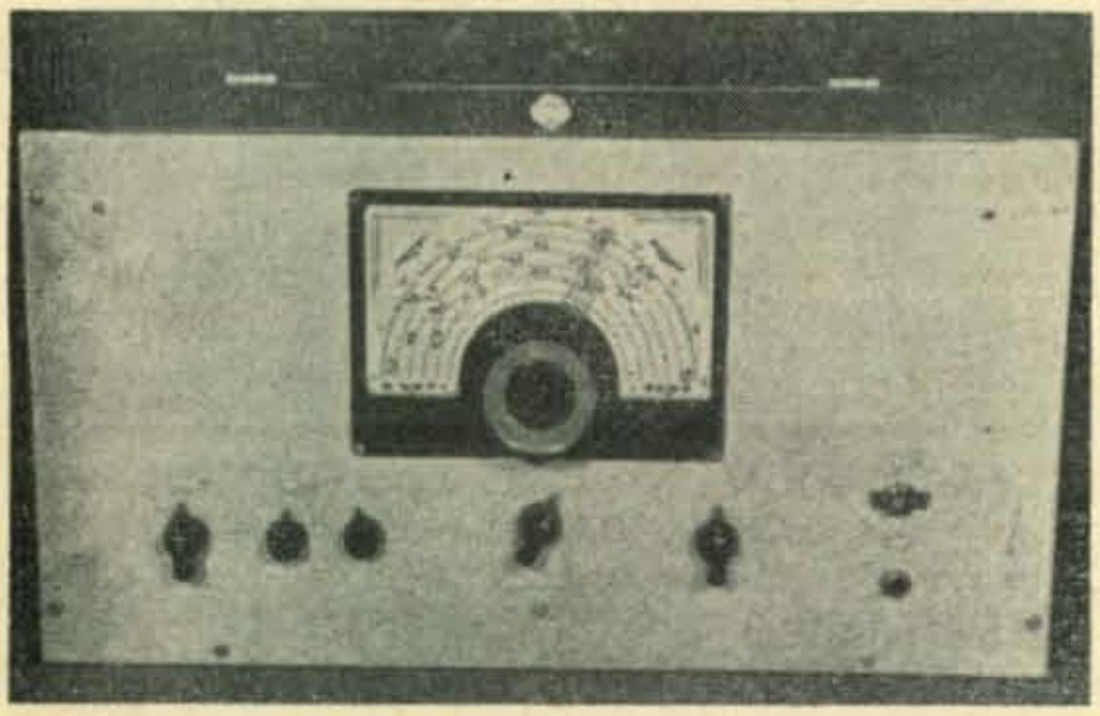
About twenty years ago I designed a very simple superheterodyne receiver called the super-gainer. It worked quite well on cw reception, particularly, and many amateurs heard world-wide DX cw signals with one form or another of this receiver. Finally, out of curosity and the fact that letters were still arriving about it, a new one was built incorporating some modern ideas to make it more serviceable in the present day crowded bands. The modern one has more tubes in order to have more gain, better selectivity and a small loudspeaker may be used if desired. However, it is still fairly simple and not too difficult to construct. Less than one microvolt cw signal is readable and phone signals of ten microvolts are understandable.

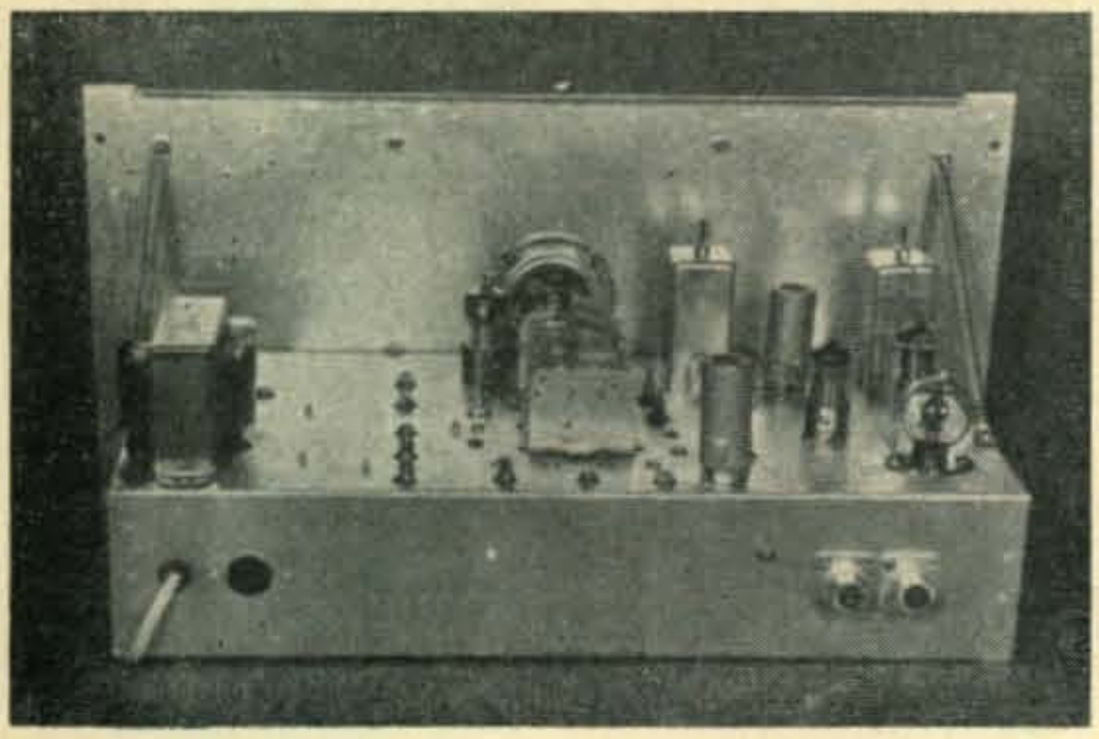
The circuit has an rf stage, a mixer-oscillator, an if stage, a regenerative second detector with two audio amplifiers and a light weight power supply. The rf stage uses a 6AB4 grounded grid system with provisions for its use as a transmit-receive switch for transmitters of up to 150 watts. The transmitter output connects to one coax fitting at the rear of the receiver, and the coaxial fed antenna or antenna tuner is connected to the other receiver coax fitting. The "T-R" function is entirely automatic and the first af amplifier in the receiver is silenced by the grid leak bias developed in the rf stage when the transmitter is on. This same grid leak system prevents the rf tube from absorbing more than a watt (or less) from the transmitter so it is possible to have break-in operation with only one antenna and no relays. The T-R function does require an rf impedance in the heater leads to keep the heater to cathode voltage at less than the maximum ratings if moderate transmitter power or a mismatched antenna is being used. A satisfactory impedance consisted of winding two 2 foot lengths of Number 28 E wire side by side on a ⅜ or ½ inch powdered iron slug. The resulting double rf choke has enough impedance to function on any of the usual amateur bands.

The grounded grid rf stage has its cathode directly driven from the antenna circuit with the grid by passed to ground. The plate circuit is coupled to the mixer grid thru a double tuned circuit with two sections of a three gang FM tuning condenser (Miller Co.). The third section tunes the oscillator. The total capacity



Front view of CW Receiver.

Back side.



Super-Gainer Coil Data

Band RF Coil (both).
3.5-4 mc—70t. #28E 1"l. x ½"d. no tap
7-7.3—35t. #26E ⅝"l. x ½"d. 17½t. tap
14-14.35—17t. #24C ½"l. x ½"d. 6½t. tap
21-21.45—11t. #20C ½"l. x ½"d. 8½t. tap
} from "gnd" end.

Band Osc Coil on ceramic coil forms (iron slugs)
3½ mc—32t. #28E ½" x ½"d. no tap
7 mc—18t. #28E ⅜" x ⅜"d. 12t. tap
14 mc—12t. #24C ⅜" x⅜". 5½t. tap
21 mc—8t #22C ⅜" x ⅜"d. 3t. tap
} from "gnd" end.

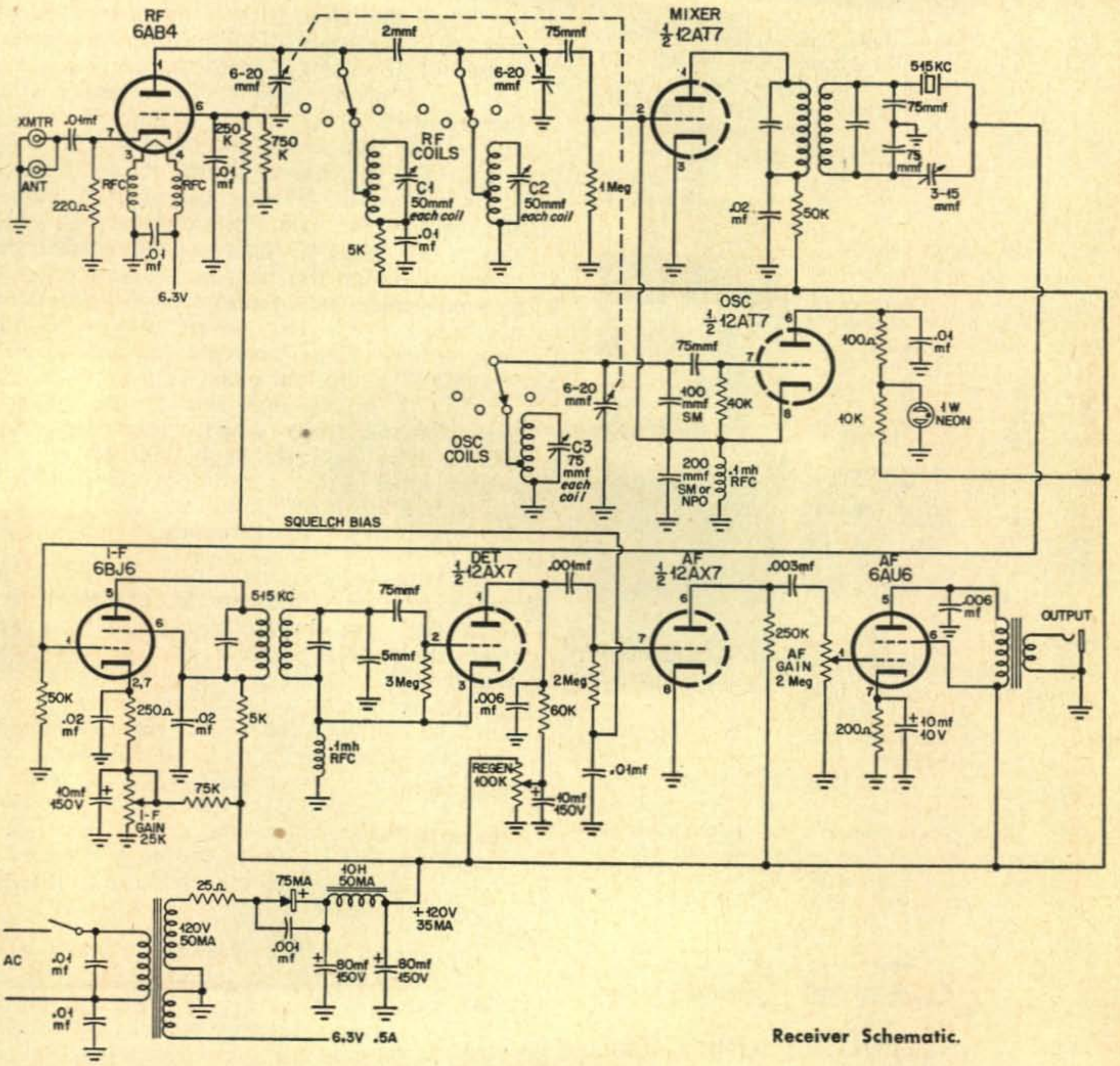
All rf coil padder cond. = mmf. max.
All osc coil padder cond. = 75 or 100 mmf max. except 3½ mc coil.

and coil taps were set up for reasonably good tracking over each of the four amateur bands. 3.5-4.0, 7-7.3, 14-14.35, and 21 to 21.45 megacycles. The writer had a four position coil switch so didn't include the ten meter band (very little cw operaiton on ten meters).

The coil data is listed in a separate table. These coils were grouped around the three section coil switch underneath the chassis along with the variable padder condensers. The rf coils were wound on lengths of half inch diameter poly rod which had one end drilled for mounting by means of either 6-32 machine screws, or by No. 6 self tapping screws. In the interest of good frequency stability, the four oscillator coils were wound on iron slug tuned ceramic coil forms (CTC forms).

The mixer plate circuit has a crystal filter with a 515 kc surplus crystal soldered into the circuit under the chassis. The "single-signal" effect or phasing condenser had the tip of one stator plate bent over (with long nosed pliers) so as to short out the crystal circuit when the phasing condenser is at full capacity. The crystal filter reduces the band width too much for phone signal reception when the latter is desired. Due partly to the loss in the crystal filter, an if stage was added. The latter has several purposes, it isolates the crystal from the regenerative and oscillating second detector and also provides a place for a gain control. It more than offsets the filter loss. The if transformers, bargain counter type, were found to tune from 550 kc to 440 kc so no modification was necessary in either one. The crystal circuit center tap was obtained by external 75 mmfd. condensers in series across one of the windings.

The heart of all super-gainer receivers is the oscillating second detector which provides a great deal of the gain and selectivity especially in the earlier models. The regenerative detector, weakly oscillating for cw reception, greatly increases the apparent Q of the last



Receiver Schematic.

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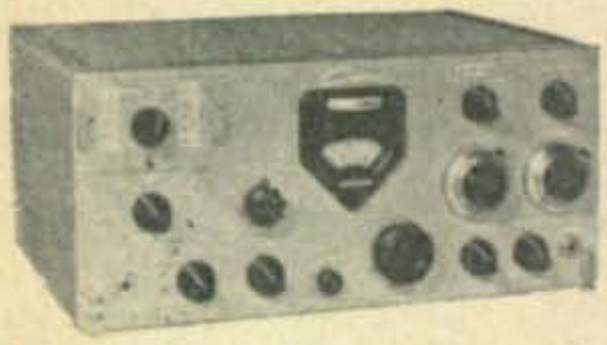
Net price .....$2,095.00.



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Buy your Collins equipment on our time payment plan. Trade in allowances will probably handle the down payment. Contact us now for complete information.

Electronic Center Inc.

107 3rd Avenue North, Minneapolis 1, Minn.

For further information, check number 24 on page 206.

Receiver [*from page 137*]

IF transformer winding similar to a Q multiplier system. Because of this effect, the usual IF transformer will be over coupled and often the primary has to be slightly detuned in order to obtain smooth control of regeneration and oscillation in the second detector. The latter consists of half of a 12AX7 or 12AT7, with the other half serving as an audio amplifier and transmit "squelch system". The second AF stage, a very small power amplifier with a 6AU6 tube, was added in order to use a small loudspeaker for comparison tests with a small commercially built receiver owned by a friend. He had an antipathy to wearing earphones. However, the loudspeaker output jack does double duty since the usual high impedance head set may be plugged into it for earphone reception.

In the rear view photograph, the 6AB4 tube is near the antenna coax fittings, with the other shielded tube being the i-f amplifier. The neon bulb voltage regulator for the oscillator is of the type with a bayonet base (no resistor in the base). This provides a regulated source of about 50 volts to the oscillator tube. The main power supply has a small transformer with a 6.3 volt 1.5 ampere winding and a 120 volt secondary rated for 50 or 75 ma. load. The receiver draws about 35 ma. A 75 ma. type of selenium rectifier, a pair of 80 μfd 150 volt electrolytic filter condensers and a 50 ma. 10 henry filter choke were mounted under the chassis. The rectifier has a small mica or ceramic bypass condenser connected across it to get rid of a tunable a-c hum effect. The receiver was built on a 7″x15″x3″ aluminum chassis fastened to front panel with screws and also a pair of angle braces made from quarter inch aluminum tubing. The cabinet, of a vintage of some earlier super-gainer receivers, was brightened up with a coat of aluminum spray paint of the type used on TV antennas.

In lining up a receiver of this type, a calibrated grid-dip oscillator is of great help. Each coil circuit can be adjusted to track over the desired amateur band before power is applied to the receiver. The r-f coil padders can be set to give good tracking over each band if the coils have the right dimensions and taps. The oscillator coils for each band must tune over the same frequency width but at 515 kc higher in frequency if a 515 kc i.f. system is used. Any surplus crystal in the range of 515 to 450 kc could probably be used by slight readjustment of the oscillator coil tuning slugs and padder condensers.

This model of the super-gainer has relatively poor performance on phone reception, but when carefully adjusted on weak c.w. signals, it will compare favorably with some fairly expensive commercially built receivers. ■

How Does Your Station Stack Up?

Kenneth E. Lohner, W6GTG
5400 Rockwell Road
North Highlands, California

Gone are the days when a transmitter, a receiver and an antenna constituted a complete amateur station. Today's station has these basic components and a number of others if it is to be considered in the blue ribbon class. Check marks in the boxes below will enable you to see how *your* station stacks up:

Fixed Station

- ☐ Conelrad monitoring device.
- ☐ Means of measuring frequency. As a minimum requirement a 100-kc crystal oscillator would determine band edges.
- ☐ Phone patch, assuming you have a telephone and your exchange serves an area with a population of 10,000 or more. See Feb. 55 *CQ* for a dandy.
- ☐ A key (even though phone is normally employed) and a means of monitoring your sending. Your receiver can often be utilized, or a simple monitor easily constructed or procured.
- ☐ A *good* station ground, to which each piece of equipment in use is connected.
- ☐ A master ac switch, and circuit overload protection of the proper value for each component fed from the ac lines.
- ☐ Antenna grounding provision. The best system is one which grounds the antenna when the station master switch is turned "off." Because of danger during lightning storms, fallen power lines, and high static-electricity levels during certain weather conditions, actual body contact with the antenna lead during grounding should be avoided.
- ☐ One-switch operation when going from receive to transmit, actuated by a push-to-talk switch on the mike, a footswitch or a switch on the rig itself.

[*Continued on page 150*]

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POWER TRANSFORMERS

Cat. No.	Hi Volt	DC Volts	DC Amps	Filament V 1	Amp.	Filament V 2	Amp.	Case Size
MGP1	400/200 ct	185	.070	6.3/5	2	6.3	3	HA
MGP2	650 ct	260	.070	6.3/5	2	6.3	4	JB
MGP3	650 ct	245	.150	6.3	5	5.	3	KB
MGP4	800 ct	318	.175	5.	3	6.3	8	LB
MGP5	900 ct	345	.250	5.	3	6.3	8	MB
MGP6	700 ct	255	.250					KB
MGP7	1100 ct	419	.250					LB
MGP8	1600 ct	640	.250					NB

PULSE TRANSFORMERS

Cat.No.	Block'g. Osc.	Int. Coupl'g.	Low. Pow. Out.	Pulse Voltage Kilovolts	Pulse Duration Microseconds	Duty Rate	No. of Wdgs.	Test Volt. KVRMS	Char. Imp. Ohms
MPT1	√	√		0.25/0.25/0.25	0.2-1.0	.004	3	0.7	250
MPT2	√	√		0.25/0.25	0.2-1.0	.004	2	0.7	250
MPT3	√	√		0.5/0.5/0.5	0.2-1.5	.002	3	1.0	250
MPT4	√	√		0.5/0.5	0.2-1.5	.002	2	1.0	250
MPT5	√	√		0.5/0.5/0.5	0.5-2.0	.002	3	1.0	500
MPT6	√	√		0.5/0.5	0.5-2.0	.002	2	1.0	500
MPT7	√	√	√	0.7/0.7/0.7	0.5-1.5	.002	3	1.5	200
MPT8	√	√	√	0.7/0.7	0.5-1.5	.002	2	1.5	200
MPT9	√	√	√	1.0/1.0/1.0	0.7-3.5	.002	3	2.0	200
MPT10	√	√	√	1.0/1.0	0.7-3.5	.002	2	2.0	200
MPT11	√	√	√	1.0/1.0/1.0	1.0-5.0	.002	3	2.0	500
MPT12	√	√	√	0.15/0.15/0.3/0.3	0.2-1.0	.004	4	0.7	700

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For further information, check number 26 on page 206.

DX

R. C. "DICK" SPENCELEY, KV4AA
Box 403, St. Thomas
Virgin Islands

Our heartiest congratulations go to the following stations upon their achievement of WAZ:

No. 358 W6TPJ Gerald A. Edmisten
40-224 (124th W6)
No. 359 W8KML Fred J. Pichitino
40-227 Phone (17th W8)
No. 360 LU6AJ Enrique Correa Keen
40-150 Phone (3rd LU)
No. 361 4X4DK Ami Shami
40-244 Phone (1st 4X4)

Of great import WAZ-wise was the advent of T1AA, Ulan Bator, Mongolia, who appealed on the air around September 3rd Ludvik is a Czech and will be at that QTH for one year. He is usually on 14061 between 0130/0230 and 1000/1200 GMT. QSL's go via OK1JK or OK1MB. As this station is making Zone 23 a fairly easy get we expect to do a land-office business with WAZ applicants . . . Another Czech, Bohous, has put YK AT on the air with 500 watts. He may be found on the lower reaches of 14 mc between 0400 and 0600 and after 1800 GMT. QSL's may go via OK1MB or Box 2249, Damascus, Syria . . . UAØKAR puts in a good signal from Dickson Island. This island is in the Kara Sea on the Arctic coast of Russia and is not a separate country (Zone 18) . . . As previously stated the F2 prefix is not exclusively for Corsica. We worked F2AN who is near Rheims . . . As we write, the authenticity of CR8AC is in doubt. Direction is OK but signals a bit too loud. He says QSL to Raul, Box 32, Vasco da Gama, Portuguese India . . . YR4CW is now active, 14017, QSL to Box 49, Honiara, Br. Solomon Islands . . . On Fanning Island VR3A arrived and VR3B departed . . . W6GMF reports that KS6AD is ex-W6TJD, 14101, at 1010 GMT. QSL to Mr. W. R. Kellen, Pago Pago, American Samoa . . . W6KG visited N.Y. with QSL's and received WPX No. 1. Congrats Lloyd! . . . VE3AHU/SU says he is on the Gaza strip and runs 500 watts . . . VS2DB has shipped an HRO receiver to ZC3AC who should be active by now . . . W2QHH nabbed FP8AS on 160! . . . PY2CK reports that PYØCV will be active from Trinidad Island from about October 1st. He will be there 40 days on 14 and 21, phone and cw (This will probably be a NEW country) . . . W9FKC advises that during a talk before the W9-DXCC'ers W2IOP stated that he has permission to operate from Vatican City and will be there, possibly with W8DUS and another W2, during the cw portion of the CQ contest . . . News about Danny is never dull and often dramatic. Now hear this: Danny acquired the YASME II in Scotland on September 10th and started sailing her down to his home port in the south of England. Off Hollyhead, while refueling, an explosion occured which blew Danny into the water where he was able to reach a buoy until rescued by a local life-boat. YASME II was a total loss. Here's Danny's statement to a Liverpool paper quote, as soon as insurance is collected for my loss I shall buy another boat and carry on as planned, unquote . . .! 73, Dick KV4AA

Mars Lectures

The Air Force MARS Eastern Technical Net, cosponsored by the Institute of Radio Engineers presents the following Guest Speakers during November. All broadcasts are on 7540 kc and start promptly each Sunday afternoon at 2:00 P.M. Eastern Time.

November 3	NUCLEAR SCIENCE SERIES. Dr. Clarke Williams, Chairman, Nuclear Engineering Dept., Brookhaven National Laboratory. Subject: Atomic Reactors.
November 10	NUCLEAR SCIENCE SERIES. Mr. Martin Plotkin, Electronic Engineer, Brookhaven National Laboratory. Subject: Electronics in High Energy Particle Accelerators.
November 17	TRANSISTOR SERIES. Mr. Elias Schutzman, Research Scientist, Transistor Research Group, New York University. Subject: Evolution, Characteristics and Applications of Transistors.
November 24	TRANSISTOR SERIES. Mr. Stanford J. Solms, Research Scientist, College of Engineering, New York University. Subject: Practical Applications, Techniques, and Ultra-miniaturization Through the Use of Transistors.

RTTY

Byron H. Kretzman, W2JTP
16 Ridge Dr., High Hills,
Huntington Station, N. Y.

CHI-RTTY Meeting

One of the most popular features of the recent (Aug. 29 to Sept. 1) ARRL Convention in Chicago was the radioteletype exhibit. Here, in actual operation, were Model 28's, 26's, and 15's connected to a two-station circuit on 3624 kc and on 7140 kc. A 2-meter afsk station was also in operation. Demonstrated was autostart, automatic transmitter control, and a conference circuit.

The highlight of this gathering of the clan was the Technical Meeting held the afternoon of August 30th. George Boyd, W9SPT, introduced the MC, Boyd Phelps, WØBP. BeeP introduced Byron Kretzman W2JPT, RTTY Editor of *CQ*, who covered RTTY fundamentals for the benefit of those convention-goers who were seeing amateur RTTY for the first time. Dave Chapman, W9DPY, discussed VFO stability, referring to the article by Cdr. Bernard that appeared in the Sept. '55 *CQ*, page 26.

Jack Pitts, W6CQK/2, showed and talked about his heterodyne exciter. (*RTTY Handbook*, page 77) Bob Springer, WØYKZ/5, discussed fsk as obtained by applying a fsk to a SSB transmitter. BeeP then talked about the operation of an RTTY station, briefly describing recent diversity reception experiments.

The most fascinating part of the meeting was the demonstration and description of new equipment, mostly transistorized, by Phil Catona, W2JAV. Shown, in actual operation, was an RTTY converter built into a polar relay case! Phil also demonstrated his transistorized afsk oscillator and his frequency meter. Equally fascinating was his audio notching filter, made from a surplus FL-8A inductor.

After adjourning for dinner, the meeting resumed with the featured talk by Bruce Rowlings, ZL1WB, who told of the difficulty in getting going "down under." Bruce paid particular tribute to the absent W6AEE for his *gift* of a Model 26 machine, and to BeeP for his lengthy and patient instructions via cw.

Door prizes were then awarded, with the First Prize, a Model 26, going to Loren Godwin, W9LKK. 255A polar relays went to K6CHR, WØCIH, and to W9CWB. W9GLR won a 1A tape head for a friend of his.

Through the kind efforts of W6CQI, W9GRW, and W9GLR, Bruce ZL1WB was

[*Continued on page 198*]

Feasting RTTY-ers at the recent ARRL convention in Chicago.

PROPAGATION

George Jacobs, W3ASK
607 Beacon Road,
Silver Spring, Md.

CQ DX Contest Special
Part 2.

Last month's column was devoted to a discussion of propagation conditions, and a special forecast, for the *Phone Section* of the *CQ World-Wide DX Contest*. This month's *CQ Propagation Charts* are devoted to a special analysis for the *CW Section* of the Contest to be held from 0200 GMT November 30th until 0200 GMT December 2nd.

Providing no radio storms develop during the Contest period (see "last minute forecast") world-wide DX during the daylight and early evening hours should be excellent on *10-meters*. Excellent DX propagation is also forecast for the *15-meter* band from dawn until early evening. *Twenty-meters* is expected to open for DX to one part of the world or another almost around the clock, with the band peaking during the afternoon and evening hours, and again shortly after sunrise. DX propagation conditions are improving on *40-meters* as the winter season nears. Fairly good DX openings to many parts of the world are expected on this band between the early evening and dawn period. Some DX should be possible on *80-meters* during the night-time hours, but at best signals are not expected to be very strong, and the band will probably be noisy. If static levels are low, some DX openings may also be possible on *160-meters* during the hours of darkness.

While not part of the Contest, the *6-meter* band is expected to open on several days of the month to *almost all areas of the world.*

Record breaking sunspot activity continues. The Swiss Federal Solar Observatory reports a monthly sunspot number of 163 for August 1957. This results in a 12-month smoothed sunspot number of 171 centered on February, 1957. A smoothed sunspot number of 155 is

Last Minute Forecast

Good shortwave propagation conditions are presently forecasted for the entire cw contest period, November 30-December 2. Moderate to severe storms are expected to occur during November 6-8, 14-16 and 22-26

ALL TIMES IN CST

Central USA To:	6/10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe	8A-10A (1)* 6A-9A (3) 9A-1P (4) 1P-4P (2)	6A-8A (3) 8A-11A (2) 11A-1P (4) 1P-4P (3) 4P-8P (2)	11A-3P (3) 3P-5P (4) 5P-11P (3) 11P-11A (2)	5P-12M (3) 8P-11P (1)**
Central & Eastern Europe	6A-8A (2) 8A-11A (3) 11A-1P (2)	5A-8A (3) 8A-11A (2) 11A-1P (3) 1P-3P (2)	12M-6A (2) 6A-12N (1) 12N-3P (3) 3P-7P (2)	6P-12M (1) 8P-11P (1)**
North & West Africa	8A-11A (1)* 7A-10A (2) 10A-12N (3) 12N-3P (2)	5A-11A (2) 11A-3P (3) 3P-6P (2)	5A-7A (2) 7A-1P (1) 1P-4P (3) 4P-1A (2) 1A-5A (1)	6P-1A (2) 9P-12M (1)**
Central & South Africa	10A-1P (1)* 6A-11A (3) 11A-2P (4) 2P-5P (3)	5A-11A (1) 11A-2P (2) 2P-5P (3) 5P-8P (2)	1P-4P (2) 4P-9P (3) 9P-2A (2) 2A-4A (1)	7P-12M (2) 9P-11P (1)**
Near & Middle East	6A-10A (2) 10A-12N (1)	9A-12N (2) 12N-2P (1)	11A-2P (2) 2P-5P (1)	6P-9P (1)
South America, Northern Area	9A-6P (2)* 7A-3P (4) 3P-6P (3) 6P-8P (2)	5A-8A (3) 8A-2P (2) 2P-8P (4) 8P-11P (1)	5A-7A (3) 7A-2P (1) 2P-4P (2) 4P-11P (4) 11P-5A (2)	7P-6A (3) 8P-3A (1)**
Argentina, Chile, etc.	9A-12N (2)* 3P-6P (1)* 6A-1P (3) 1P-4P (4) 4P-7P (3)	6A-2P (2) 2P-8P (3) 8P-10P (2)	5A-8A (3) 8A-3P (1) 3P-9P (3) 9P-5A (2)	7P-4A (2) 8P-3A (1)**
India, Pakistan & Central Asia	7A-9A (1) 6P-9P (1)	7A-10A (2) 5P-9P (2)	8A-11A (2) 5P-9P (2)	NIL
Malaya & Southeast Asia	8A-1P (2) 4P-7P (2)	8A-1P (1) 1P-5P (2) 5P-7P (3) 7P-9P (2)	5A-9A (2) 6P-12M (2)	NIL
Philippine Islands & East Indies	7A-9A (1) 5P-7P (2)	7A-10A (1) 5P-9P (2)	6A-8A (1) 5P-10P (2) 10P-1A (1)	NIL
Japan & Far East	3P-6P (1)* 2P-4P (2) 4P-7P (3) 7P-9P (2)	2P-4P (2) 4P-8P (3) 8P-10P (2)	3P-7P (1) 7P-9P (2) 9P-2A (3) 2A-10A (2)	12M-7A (1)
Australasia	3P-6P (1)* 8A-11A (3) 11A-3P (2) 3P-7P (4) 7P-9P (3)	7A-10A (3) 10A-4P (2) 4P-10P (3) 10P-1A (2)	9P-12M (2) 12M-4A (4) 4A-9A (3)	2A-8A (3) 4A-7A (2)**
Guam & Pacific	4P-6P (1)* 8A-11A (1) 4P-8P (3) 8P-10P (2)	8A-11A (2) 4P-6P (2) 6P-9P (3) 9P-11P (2)	7P-10P (2) 10P-3A (3) 6A-8A (2)	10P-1A (1)
Hawaii	11A-5P (2)* 10A-12N (3) 12N-7P (4) 7P-9P (3)	10A-4P (3) 4P-9P (4) 9P-12M (3) 12M-2A (2)	4P-6P (3) 6P-4A (4) 4A-10A (3) 10A-4P (2)	10P-7A (4) 11P-6A (3)**
Antarctica	7A-9A (1) 6P-10P (1)	6A-9A (2) 9A-2P (1) 2P-10P (3) 10P-12M (2)	3P-7P (1) 7P-9P (2) 9P-3A (3) 3A-8A (2)	12M-3A (2)

ALL TIMES IN EST

Eastern USA To:	6/10 Meters	15 Meters	20 Meters	40/80 Meters
Western Europe	9A-11A (2)* 6A-10A (3) 10A-2P (4) 2P-5P (2)	6A-12N (3) 12N-5P (4) 5P-8P (3) 8P-10P (2)	8A-1P (3) 1P-7P (4) 7P-1A (3) 1A-8A (2)	5P-7P (3) 7P-4A (4) 7P-3A (2)**
Central Europe	8A-10A (1)* 6A-8A (2) 8A-11A (3) 11A-2P (2)	5A-10A (2) 10A-1P (3) 1P-4P (2)	1A-5A (2) 5A-7A (3) 7A-11A (2) 11A-4P (3) 4P-9P (2)	5P-7P (2) 7P-1A (3) 9P-11P (1)**
Eastern Europe (USSR)	7A-11A (2)	7A-9A (2) 9A-11A (3) 11A-1P (2)	6A-10A (1) 10A-3P (2) 3P-7P (1)	6P-12M (1)
Scandanavia & North Europe	8A-12N (1)* 6A-8A (2) 8A-12N (3) 12N-2P (2)	5A-8A (2) 8A-2P (3) 2P-4P (2)	3A-7A (2) 7A-11A (1) 11A-3P (3) 3P-6P (2)	5P-9P (1)
Mediterranean West	8A-12N (1)* 6A-8A (2) 8A-12N (4) 12N-2P (3) 2P-5P (2)	5A-11A (3) 11A-2P (4) 2P-4P (3) 4P-7P (2)	3A-8A (3) 8A-12N (2) 12N-5P (4) 5P-11P (3) 11P-3A (2)	6P-3A (3) 9P-2A (2)**
Mediterranean East	8A-10A (1)* 7A-11A (3) 11A-1P (2)	6A-8A (3) 8A-11A (2) 11A-2P (3) 2P-4P (1)	1A-7A (2) 7A-12N (1) 12N-3P (2) 3P-6P (1)	6P-1A (1)
West Africa	8A-11A (1)* 7A-11A (2) 11A-1P (3) 1P-4P (2)	5A-12N (2) 12N-4P (3) 4P-7P (2)	5A-8A (2) 8A-1P (1) 1P-5P (3) 5P-1A (2) 1A-5A (1)	6P-2A (2) 9P-1A (1)**
East Africa	8A-11A (1)* 7A-9A (1) 9A-11A (3) 11A-2P (2)	6A-10A (1) 10A-12N (2) 12N-3P (3) 3P-5P (2)	11A-2P (1) 2P-4P (2) 4P-6P (3) 6P-11P (2) 11P-1A (1)	6P-9P (1)
Central & South Africa	9A-1P (1)* 6A-11A (2) 11A-2P (4) 2P-6P (3)	5A-10A (1) 10A-12N (2) 12N-5P (3) 5P-9P (2)	11A-1P (1) 1P-3P (2) 3P-9P (3) 9P-4A (2)	9P-1A (1)
South America Northern Area	9A-11A (2)* 2P-6P (1)* 7A-3P (4) 3P-6P (3) 6P-8P (2)	5A-8A (3) 8A-1P (2) 1P-7P (4) 7P-9P (3) 9P-11P (1)	5A-7A (3) 7A-1P (1) 1P-3P (2) 3P-11P (4) 11P-5A (2)	7P-6A (3) 9P-4A (1)**
Argentina, Chile, Etc.	9A-12N (2)** 3P-6P (1)* 7A-1P (2) 1P-5P (3) 5P-7P (2)	6A-2P (2) 2P-8P (3) 8P-10P (2)	5A-8A (2) 8A-3P (1) 3P-9P (3) 9P-5A (2)	7P-4A (2) 8P-10P (1)** 2A-4A (1)**
Near & Middle East	6A-11A (2) 11A-1P (1)	5A-9A (1) 9A-1P (2)	12M-3A (2) 3A-7A (1) 11A-3P (2) 3P-5P (1)	6P-9P (1)
India & Pakistan & Central Asia	7A-9A (1)* 6P-9P (1)	7A-8A (1) 8A-10A (2) 10A-11A (1) 5P-9P (2)	7A-9A (1) 9A-12N (2) 5P-9P (1)	NIL
Malaya and Southeast Asia	7A-11A (2) 5P-7P (2)	7A-9A (2) 5P-9P (2)	5A-9A (2) 6P-12M (2)	NIL
Philippine Is. & East Indies	7A-10A (1) 5P-7P (2)	7A-10A (1) 5P-9P (2)	6A-8A (1) 5P-8P (1) 8P-2A (2)	NIL
Japan & Far East	4P-7P (3)	4P-6P (2) 6P-8P (3) 8P-10P (2)	5P-8P (1) 8P-1A (2) 1A-8A (3) 8A-10A (2)	2A-8A (1)
Australasia	4P-7P (1)* 9A-12N (2) 12N-5P (1) 5P-8P (3) 8P-11P (2)	9A-12N (2) 12N-5P (1) 5P-10P (3) 10P-1A (2)	6P-10P (1) 10P-4A (3) 4A-8A (2) 8A-10A (1)	4A-8A (2) 5A-7A (1)**
Guam & Pacific	4P-6P (1)* 9A-11A (1) 4P-8P (3)	8A-11A (2) 4P-6P (2) 6P-9P (3) 9P-11P (2)	7P-10P (2) 10P-3A (3) 6A-8A (2)	10P-1A (1)
Hawaii	1P-5P (1)* 12N-2P (2) 2P-6P (4) 6P-9P (3)	11A-5P (2) 5P-9P (4) 9P-10P (3) 10P-1A (2)	11A-1P (2) 1P-5P (1) 5P-7P (2) 7P-10P (4) 10P-3A (3)	12M-7A (3) 1A-6A (2)**

ALL TIMES IN PST

Western USA To:	6/10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Central Europe	6A-8A (2) 8A-10A (3) 10A-12N (2) 12N-2P (1)	6A-9A (2) 9A-12N (3) 12N-2P (2) 2P-4P (1)	1A-4A (1) 10A-12N (1) 12N-4P (2) 4P-6P (1)	7P-11P (1)
Southern Europe & North Africa	8A-11A (1)* 6A-8A (2) 8A-11A (3) 11A-2P (2)	6A-10A (2) 10A-12N (4) 12N-2P (3) 2P-4P (2)	5A-11A (1) 11A-1P (2) 1P-3P (4) 3P-8P (3) 8P-5A (2)	7P-11P (1)
Central & South Africa	8A-3P (1)* 6A-9A (1) 9A-1P (3) 1P-3P (4) 3P-7P (3)	8A-11A (1) 11A-2P (2) 2P-7P (4) 7P-10P (3)	11A-3P (1) 3P-5P (2) 5P-10P (3)	7P-9P (1)
South America, Northern Area	8A-5P (1)* 6A-1P (3) 1P-6P (4) 6P-8P (2)	6A-2P (3) 2P-6P (4) 6P-8P (3) 8P-10P (2)	2P-4P (3) 4P-8P (4) 8P-10P (3) 10P-2P (2)	6P-3A (3) 9P-2A (2)**
Argentina, Chile, Etc.	9A-2P (1)* 6A-12N (2) 12N-6P (3) 6P-8P (2)	6A-8A (2) 8A-1P (1) 1P-6P (3) 6P-10P (2)	2P-5P (2) 5P-8P (3) 8P-2A (2)	9P-2A (2) 10P-1A (1)**
India, Pakistan & Central Asia	4P-7P (2)	3P-6P (3) 6P-9P (2)	7A-9A (2) 9A-3P (1) 3P-6P (2) 6P-10P (1)	2A-8A (1)
Philippine Islands & East Indies	3P-6P (1)* 8A-10A (2) 2P-5P (3)	8A-2P (3) 2P-6P (1) 6P-10P (2)	7A-11A (3) 8P-1A (2)	4A-8A (1)
Malaya & Southeast Asia	9A-11A (2) 2P-8P (3)	9A-12N (3) 12N-3P (1) 3P-6P (3) 6P-8P (2)	12M-7A (2) 7A-10A (3) 10A-1P (1)	4A-8A (1)
Hong Kong, China & Formosa	3P-5P (1)* 2P-8P (3)	1P-6P (2) 6P-8P (3) 8P-10P (2)	8A-1P (2) 1P-6P (1) 6P-8P (2) 8P-12M (3) 12M-8A (1)	1A-8A (2)
Japan, Okinawa & Far East	3P-5P (2)* 1P-4P (3) 4P-6P (4) 6P-8P (3)	1P-6P (2) 6P-8P (3) 8P-10P (2)	7A-12N (3) 12N-8P (1) 8P-11P (3) 11P-7A (1)	11P-8A (2) 12M-5A (1)**
Australia	2P-5P (1)* 8A-2P (2) 2P-6P (4) 6P-8P (2)	7A-12N (3) 12N-6P (1) 6P-8P (3) 8P-10P (2)	7A-10A (3) 10A-8P (1) 8P-1A (3) 1A-4A (2)	2A-6A (3) 6A-8A (2) 3A-6A (2)**
New Zealand	2P-6P (1)* 10A-5P (3) 5P-7P (4) 7P-9P (3)	7A-11A (3) 11A-6P (1) 6P-10P (3) 10P-12M (2)	7A-9A (3) 9A-8P (1) 8P-12M (3) 12M-3A (2)	10P-6A (3) 12M-2A (2)** 2A-6A (1)**
Fiji & New Hebrides	2P-6P (1)* 8A-1P (3) 1P-6P (2) 6P-9P (3)	8A-12N (3) 12N-4P (2) 4P-10P (3) 10P-12M (2)	7A-10A (3) 10A-7P (1) 7P-12M (3) 12M-4A (2)	12M-6A (2) 2A-6A (1)**
Guam & Pacific Islands	2P-5P (1)* 12N-2P (3) 2P-6P (4) 6P-9P (3)	8A-12N (2) 12N-2P (3) 2P-6P (2) 6P-9P (3) 9P-12M (2)	7A-12N (3) 12N-7P (1) 7P-11P (3) 11P-7A (2)	12M-8A (3) 2A-7A (2)**
Aleutians & Siberia	2P-5P (1)* 12N-2P (3) 2P-7P (4) 7P-10P (2)	11A-5P (3) 5P-8P (4) 8P-10P (2)	8A-12N (3) 12N-6P (2) 6P-9P (4) 9P-11P (3) 11P-3A (2)	9P-8A (3) 11P-7A (2)**

SYMBOLS FOR NUMBER OF DAYS CIRCUIT PREDICTED TO OPEN:

(1) 1 - 4 days (2) 5-11 days (3) 12-18 days (4) 19-26 days (5) over 26 days

* Indicates time of possible six-meter openings.
** Indicates time of possible eighty-meter openings.

The CQ Propagation Charts are based upon a CW radiated power of 150 watts and are centered on Washington, D. C., St. Louis, Mo., and Sacramento, California. These forecasts are calculated from basic ionospheric data published by the CRPL of the National Bureau of Standards and are valid through December 15, 1957.

now forecast for November, 1957.

Good Luck during the CW Section of the Contest. Any comments readers of this column may have concerning observations during the Contest would be appreciated.

73, George, W3ASK

Subscribing

I make a lot of noise every month trying to get everyone to subscribe to CQ. Despite my persuasiveness quite a few readers continue to buy off the newsstand. This is quite a bedevilment to me since we only send just so many copies of CQ to the newsstand distributors and they usually sell out in the first couple days. If you fellows would subscribe then we might be able to let some new people see the magazine on the stands.

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As a student of mail order psychology I realize that it is a tremendous accomplishment to get readers to actually get an envelope out, fill in the address, stamp it, make out a check (or go to the post office for a money order) and get the whole thing in to us. That money order thing is a real headache. We are pretty honest at CQ, so if you decide to throw caution to the winds and send cash you will find that everything will be all OK. The post office loses a handful of letters every year out of billions so stop worrying. Slip a ten dollar bill in an envelope, include your name and address and a hint as to whether the sub is new or renew and you'll get CQ for three long long years.

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FOR SALE

SELL: Hallicrafter S-94, excellent condition, $35, will ship postage or express collect. Joe Nuzzolo, 1831 Southern Blvd., Bronx 60, N.Y.

W.E. TUBES: 404A, 417A, 416B. New in W.E. Cartons. Make offer. George E. De Brien, W2EEM, 145 Avon Rd., Syracuse, N.Y.

TBS-50-C (80-2m xmtr) with preamp, APS-50 pwr supply, Heath VFO, mike & misc., $100. Also: VOM, $5; 1n Eico VTVM, $20; Precision 912 tube tester, $25; SSB exciter kit, $30; SX-43 & R-46, $100; PE-103, $25; AR-2 rcvr, $20; code records, $5; list of other gear sent. R. Rush, W9TGH, 260 S. Ritter, Indianapolis 19, Ind.

B&W S100, SX96, D104, 100 and 1000 kc crystal calibrator, negative peak indicator and power supply, set of B&W Baluning coils, PE103A, 210KK electro voice mike. All equipment like new. John Gray, W5IQA, Box 505, Daingerfield, Tex.

FOR SALE: Two vocaline transceivers used very little, in good condition. Complete with inside and one outside antenna, microphones, $100. Ron Jones, 518 Polk, Topeka, Kans.

FOR SALE: TV camera model CRV-59 complete and ready to go on the air (less power supply) with complete instructions, $99 plus shipping charges. Other ham and surplus equipment. Write for list. Syd Moate, W6ZEM, 18152 Sunburst St., Northridge, Calif.

BARGAINS GALORE: Insulated wire all types. Let us know your requirements. THRIFTY DISTRIBUTORS, P O Box 43, Millbury, Mass.

FOR SALE: Precision 954 tube and set tester, $65. Precision E-200-C signal generator, $35. Heathkit 425 'scope, $25. Hammerlund HQ-129-X communication receiver, $100. All above in very good condition. M. Vassallo, W2WUL, 99 Greenpoint Ave., Brooklyn, N.Y. Phone JA 1-7661.

FOR SALE: HQ-150 receiver and speaker. Just like new, modified six meter Tecraft converter, $250. Will deliver 100 mile radius. Carl Willis, K8DKO, 464 Forest St., Mansfield, Ohio

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FOR SALE: Trav-Electric Super-Converter. Terado Co. Input 6v D.C. output 110v AC 60w continuous, 75w intermittent. Perfect condition $19. Rev. Robert Mark, 130 Main St., Wellsboro, Pa.

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FOR SALE: Little used Globe Chief 90, $40. AT-1 and AC-1, $25. Tom Homewood, K8AEN, 5209 Second Ave., Vienna, W. Vir.

COLLINS receiver 75A4 in original unopened crate, $595, 32V1 exmitter, $255. 300w modulator, $35. Crystal, for 2 and 6 meters, 6 for $1. Ronald E. White, W61MC. 403 Alden Road, Hayward, Calif.

BARGAINS WITH NEW GUARANTEE: HQ-100C $145; HT-20 xmtr $249; Collins 32V3 $495; SX-100 $229; TBS-50C $69; TBS-50D $69; APS-50 p.s. $29.50; TBS VFO $35; Lysco 382 VFO $19.95; Lysco 600 $69; Eldico TR-75TV $25; B&W 5100 $299; Adventurer $34.50; Knight CW xmtr. $34.50; Gonset #3024 VFO $45; Sonar SRT-120P $129; Globe Trotter $29.50; Globe King 500A $495; Globe King 275 $199; Globe King 400B $275; Scout 65A $69; Scout 65B $75; Globe King 400C TVIed $299; Globe King 500B $599. Free trial, terms, write Leo, WØGFQ, for best deals. WORLD RADIO LABORATORIES, 3415 West Broadway, Council Bluffs, Iowa.

FOR SALE: Hallicrafters SX-28, $125; Heathkit DX-100, $195; DX-35, $55; MM-1 Multimeter, $25. Gene Tomlinson, Sullivan Ave., W1OQC, South Windsor, Conn.

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FOR SALE: #12 Teletype machine—W2BFD panel has not been used for 2 years—may need cleaning up. Complete with paper rolls and all manual, $75. K2JKX, 167-16 73rd Ave., Flushing 66, N.Y. Phone OL 7-6659.

FOR SALE: 6 meter 15w shielded xmtr complete with modulator and power supply, $95. Tecraft 6 meter converter, $30. NC100 ASD receiver, $50. Richard Vogeley, W2IPB, 554 Seventh Ave., New Hyde Park, N.Y.

FOR SALE: Two 2 meter ARC-4's, converted with tubes, $25 each, FOB Athens. National Select-O-Ject, $8. Jim Grant, W4UVU, Athens, Tenn.

FOR SALE: Tubes, brand new 813s, $8; 810s, $7.50; 832As, $3.50; 811s, $2.25; 250th, $15; 4-250A, $20; complete Motorola FM 30-40 mc receiver, $125; Motorola FM xmitter, $100; complete Collins heavy duty power supply, $35; Elmac 6v mobile receiver supply, $20; ARC-4 two meter xceiver complete with tubes, $45; plate transformer 115v-3200vct-200mils, $20; BC-221AC frequency meter original calibration book, $75; BC-322 xceiver ideal for 6 meters, $25; Gonset two meter mobile converter works off car radio, $25; Navy atd xmitter, $20; complete Master all bander coil, whip, car mount, $18; SCR-522 power supply, $12. Have new parts for ART-13, BC-348, SCR-522. Write what you need. All guaranteed. Can ship COD. Bill Slep, Box 178, Ellenton, Fla.

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ATTENTION MOBILEERS!! Leece Neville 6 volt 100 amp. system alternator, regulator and rectifier, $45.00. Also Leece Neville 12 volt 100 amp. system, alternator, regulator & rectifier $85.00. Perfect condition. Herbert A. Zimmerman, Jr. 115 Willow St., Brooklyn 1, N. Y. K2PAT, ULster 2-3472.

CRYSTALS: FT-243's—3500 to 8700 KC ±2 KC, $1.00 each. .01% setting, $2.00 each. Hundley Crystal Co., 2951 North 36th, Kansas City 4, Kansas.

NEW G66B with power and speaker, best offer. 813's, $9; 4X150 & socket, $15; 4-125's, $12; 4-250's, $20; VVC 20-60, $35; 2 vocaline T.R.s as new, $90 pr.; KW plate & mod. Trans. Baker, W8QJR, Box 546, McComb, Ohio.

PE-103 Owners: 8 pin Cannon plug made for the PE-103. Brand new, $1.50 ppd. Horowitz, W2CRJ, 216 17th Ave., Paterson, N.J.

FOR SALE: One 800w transmitter, p.-p. 813's; one Hallicrafter receiver, SX28-A. Both in A-1 condx, $450. FOB New Bern, N.C. W. H. Abernathy, P O Box 152, New Bern, N. C.

NEW AMATEURS: Check with Roswel Electronics at 306 Prospect St., Cambridge, Mass., for your amateur needs.

WANTED

WANTED: All types receivers, transmitters, test equipment, teletype. Also especially AN/URA-8A converter-comparator, APN-9, APR-9, BC-348, BC-342, BC-610, BC-221, ART-13, ARC-1, ARC-3. Cash or trade for NEW Johnson Thunderbolt, Courier, Navigator, Valiant, Ranger, National, Hallicrafters, Hammarlund, B&W, Telrex, Elmac, Gonset, Fisher H-Fi, Bell, etc. Write Tom, W1AFN, ALLTRONICS-HOWARD CO., Box 19, Boston 1, Mass. Phone Richmond 2-0048. Store: 60 Spring St., Newport, R.I.

WANTED: 10-B, 20-A or other SSB exciter; also 75A-1, 75A-2 or 75A-3 receiver. J. P. Jerome, W7DBA, P O Box 586, Yakima, Wash.

WANTED: Band spread coil set covering 15 meter band for National HRO 5-TA-1 receiver. F. Thiede, W2EC, 169 Buckingham Rd., West Hempstead, L.I., N.Y.

WANTED: 15 meter bandspread coil for National HRO-7T. R. Skyten, K2RKN, 5 Trelign Drive, North Syracuse, N.Y.

WANTED: Collins 800 cycle mechanical filter for 75A3 receiver. N. Grasso, W8OYP, 1619 Wood Road, Cleveland Hts. 21, Ohio

---

WANTED: Used receivers and transmitters. Will pay cash or trade. 10% down with up to 24 months to pay. In stock new 75A4's, KWSL's, KWM-1 SSB mobile transceiver, Johnson, B & W, National, WRL Products, Hallicrafters, Elmac, Hammarlund, Gonset, Central Electronics, Moseley, Hy-Gain and Gotham Beams. Write for list of bargains in reconditioned receivers and transmitters with new guarantee. Shipped on approval. Write Ken, WØZCN or Glen, WØZKD for your best deal. KEN-ELS RADIO SUPPLY CO., 428 Central Ave., Ft. Dodge, Iowa.

WANTED: ARC-3, ART-13, ARC-1, BC-348, BC-221, BC-610E and other military surplus and commercial aeronautical equipment. You ship COD, we pay freight. Write, wire, phone. JAMES S. SPIVEY INC., 4908 Hampden Lane, Washington, D.C. Phone OLiver 6-8608.

WANTED: An/GRC 3-4, AN/GRC 5-6, An/GRC 7-8, AN/PRC 8 (20-28 mcs), AN/PRC 9 (27-35 mcs), AN/PRC 10 (38-55 mcs). State condition and price. Write to Box 916, Fort Orange Radio Distributing Co., 904-916 Broadway, Albany 4, N.Y.

MISCELLANEOUS

QSL's. Glossy. Samples 10c W1OLU Press, 30 Magoun Ave., Medford, Mass.

QSL's, samples 10c. Gay Krenz, Fall Creek, Wis.

DELUXE QSL's. Petty, W2HAZ, Box 27, Trenton, N.J. Samples 10c.

QSL's-SWL's samples 10c. Malgo Press, 1937 Glendale Ave., Toledo 14, Ohio.

CREATIVE QSL & SWL CARDS. Are you proud of your card? If not, let us print your next order. Write for booklet and samples. Personal attention given to all requests. Bob Wilkins, Jr., Creative Printing, KN6ZMT, P O Box 1064-B, Atascadero, Calif.

QSL SPECIAL: Free Samples. Nat Stinnette, W4AYV, Umatilla, Fla.

QUALITY QSL's. Samples, 10c Lee, W5CZA, Box 7171, Oklahoma City, Oklahoma.

QSL's "Brownie" W3CJI, 3110 Lehigh, Allentown, Pa. Samples, 10c with catalogue, 25c.

QSL's, SWL's, VHF's, XYL-OM's. (Sample assortment approx. 9¾c) Covering designing, planning, printing, arranging, mailing, eye-catching, comic, sedate, fatabulous, DX-attracting, prototypal, snazzy, unparagoned, cards. Rogers KØAAB, 737 Lincoln Ave., St. Paul 5, Minn. Also glamourous, pulsating, super-passionate. (Wow!)

QSL SAMPLES. Dime. refundable. Roy Gale, Waterford, Conn.

QSL-SWLS. High quality, reasonable, prices, samples. Bob Teachout, WIFSV 204 Adams St., Rutland, Vt.

QSL's Samples, dime. Print Shop, Corwith, Iowa.

OUTSTANDING QSL or SWL samples, 25c (refunded). CALLBOOKS (latest) $4.50. "Rus" Sackers, W8DED, P O Box 218, Holland, Mich.

QSL's: We've printed a million. Samples 10c. VYS Print, 1704 Hale Ave., Ft. Wayne, Ind.

CHRISTIAN DIRECTORY of hams, 35c. "Hams for Christ", P O Box 218, Holland, Mich.

JESUS SAVES and satisfies. Request free folder. "Hams for Christ" P. O. Box 218, Holland, Mich.

SWAP OR SELL

ONE SURPLUS BC-800 transmitter-receiver with all tubes w/o power supply. Brand new, still in carton for mobile receiver or citizen's band equipment. C. Albanese, 135 Perth Rd., North Madison, Ohio

SWAP: New Minifom pocket-size wire recorder, cost $380 for good SX-101 or NC-300 receiver. W. Abbott, 173 Del Mar, Costa Mesa, Calif.

SELL OR SWAP: Hammarlund SP600 recvr, like new. Best offer over $365. SX-25 recvr; TBS 50C xmtr; Elmac A54H xmtr; Morrow 3BR converter; SWR bridge; T-R switch; Heath Q-mult; 30w mod. transformer. Many transformers, relays, parts & meters. List free. Want Viking Ranger, also cabinet only for BC654. D. Hansen, WØZOB, Box 273, Coleraine, Minn.

COLLINS 30K-1 xmtr in excellent condition. Will accept old, quality violin. Owel Barton, 1609 W. 3rd St., Ft. Wayne, Ind.

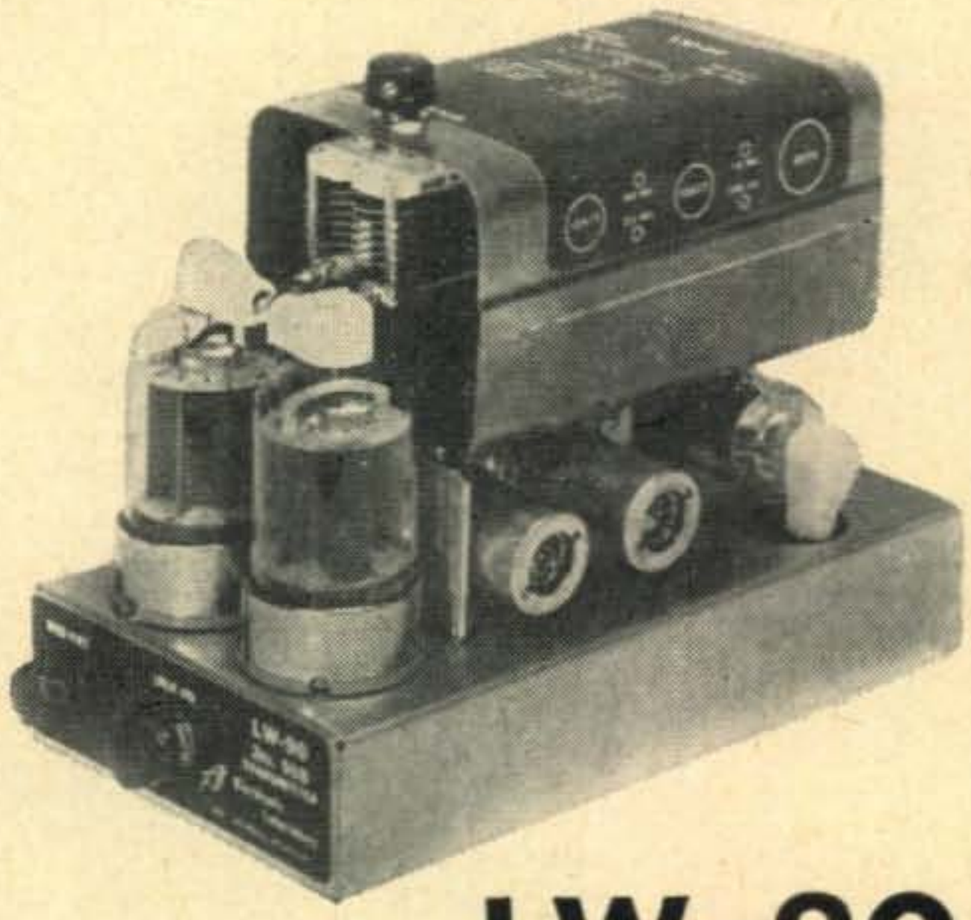
BUY, SELL, SWAP—Test or Ham equipment. State needs or lowest price and condition. W4FXQ, 4857 Appleton St., Jacksonville, Florida.

INSTRUCTION

CODE COURSE SUPREME, on Magnetic Recording Tape. Results guaranteed. Novice tape, basic instruction, practice material to 8 WPM, $6.50. Advanced tape, practice material 9 to 18 WPM, $5.50. Combined $11.00.7-inch dual track 3¾ IPS. TAPEDCODE, Box 31-F, Langhorne, Penna.

SSB
on TWO m.

(SIX m. model soon)



LW-90

150 watts P.E.P. input

High efficiency Linear Tanks

Final tank lines Silver plated

Butterfly tuned

Drive from any SSB generator

with a few watts on 14-14.5 Mc.

Use VFO on SSB Generator

Wired & Tested with

Tubes & Crystal

$99.50 (subject to change)

complete details from:—

ELECTRONIC LABORATORY

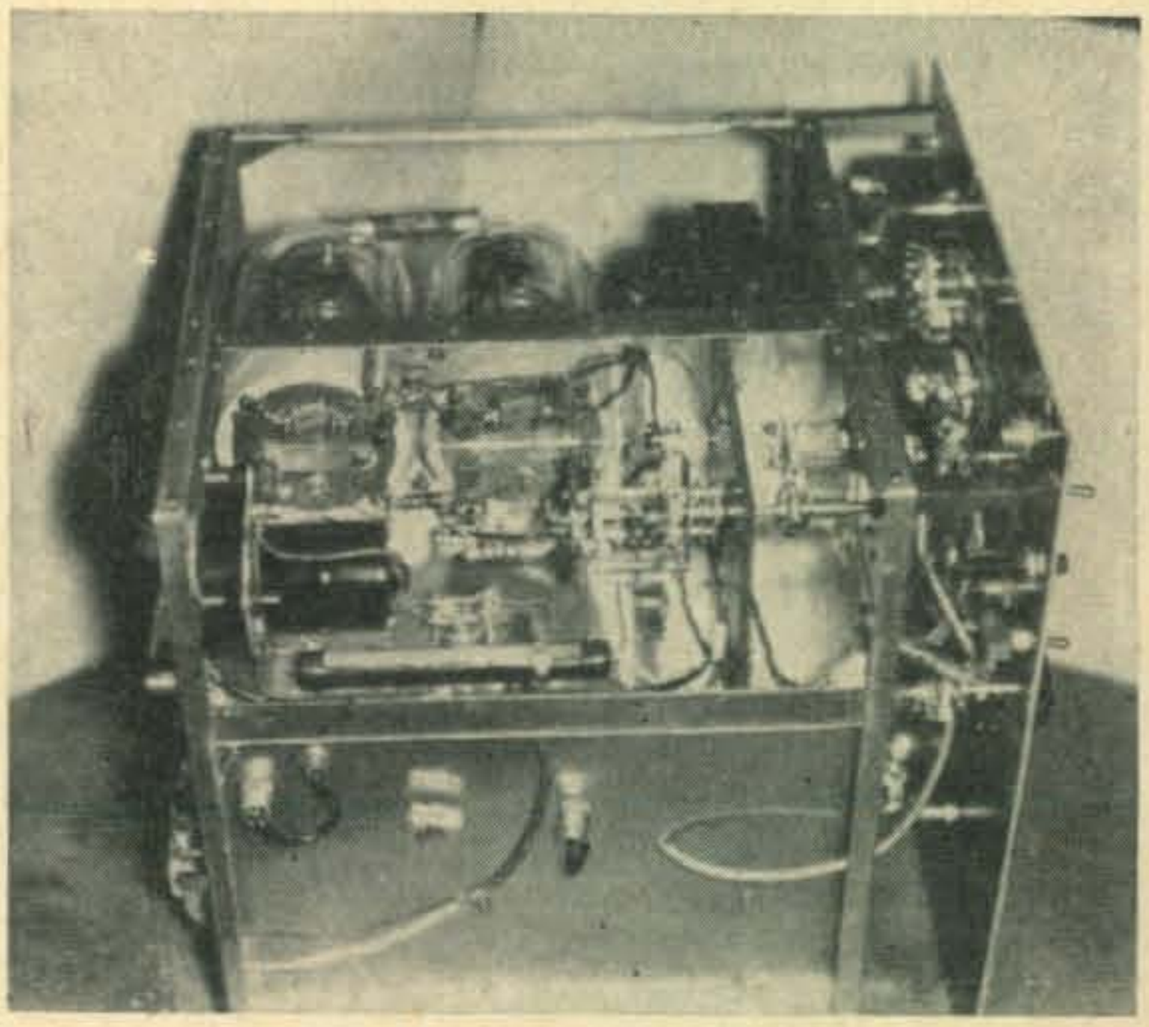
ROUTE 2, JACKSON, MICHIGAN

For further information, check number 67 on page 206.

4-400A *[from page 107]*

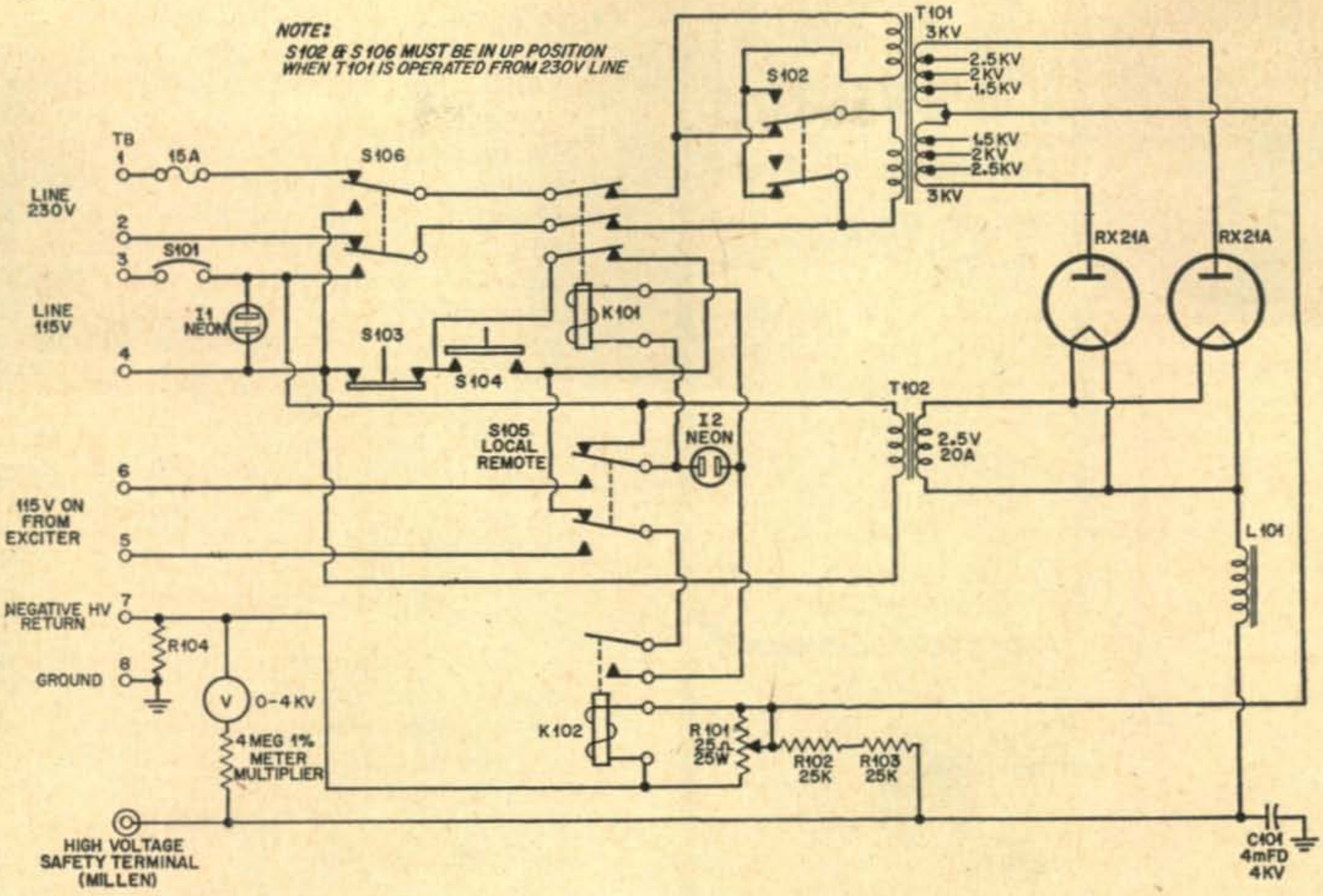
4-400A Power Amplifier Parts List

R1	250 Ohm 50 Watt Ohmite #0568
R2	5K Ohms 25 Watt Rheostat Ohmite #0162
R3, 4	47 Ohm 2 Watt Ohmite
R5	25 Ohm 10 Watt Non-inductive (Globar)
C1	400 mmfd Silver Mica
C2	140 mmfd variable EF Johnson #140R12
C3, 4, 5, 6, 7, 8, C9, 10, 11, 12, 13, 14	.002 mfd 600 Volt disc ceramic .01 mfd 600 volt disc ceramic
C15, 16	.001 mfd 600 V mica or ceramic
C17, 18, 19	500 mmfd 20,000 volt TV ceramic doorknobs
C20	Jennings vacuum variable 10-400 mmfd 10 kV Type UCS
C21	Cardwell Type PL 8013 50-1500 mmfd variable
C22, 23, 24, 25	.0002 MF 1000 Volt mica or ceramic
M1	0-100 DC milliamperes Weston model 301
M2	0-10 Volts AC Weston model 476
M3	0-200 DC milliamperes Weston model 301
M4	0-1000 DC milliamperes Weson model 301
M5	Part of Jones VSWR indicator model 262
L1, 2	Neon type indicator (EF Johnson 147-1143)
RFC 1, 2	2½ MH 100 mA (National R-100U)
RFC 3	EF Johnson 102-754 or National R-175A
RFC 4	2½ MH 300 mA (National R-300)
RA1, 2	Right angle drives National or Millen
S1	SPST toggle switch 5 Amp
S2	SPDT toggle switch
S3	3 pole 3 position shorting type ceramic deck switch Centralab #2506
S4	B & W Co-ax antenna selector
S5	SPST toggle switch, 5 Amp Jones VSWR Ind. Unit #262
S6	SPDT toggle switch. Part of
S7	DPDT 5 Amp contacts
V1, 2	Eimac 4-400A tubes
SK1, 2	Eimac SK-400 Air system sockets
LPF	Low Pass filter EF Johnson or B & W
NC	Neutralizing capacitor 1-7 mmfd EF Johnson N-125 or Millen 15011
COUPLING UNIT	Jones Model #261
VSWR IND	Jones Model #262 (Includes M5 and S5)
B1	Blower 17 CFM Ripley Model #8433
K1	DPDT relay Advance #CD/1C/115 VAC
K2	Antenna co-ax relay Advance AM/2C/115 VAC
T1	Superior Electric Co. Powerstat Model #10 (115V 150 Watts)
T2	5 Volt 30 Amp filment transformer Stancor #P6468
L1 to L10	B & W turret Model 2A modified as follows: **L1 and L6 (10 meters) removed from assembly and replaced with 4 turns of B & W miniductor, #3001 L1 Two turns of #20 hookup wire wound at one end of this miniductor.** **L2, 3, 4, 5 unchanged.** **L7 (15 meters) Remove turns until 4 turns are left on coil. L8 (20 meters) Remove turns until 6 turns are left on coil. L9 (40 meters) Remove turns until 13 turns are left on coil. L10 (80 meters) Remove turns until 22 turns are left on coil.**
L11	B & W bandswitch coil model #850
L12	10 henries 100 mA choke Stancor C1001
L13	16 turns of #20 enamelled wire center-tapped, wound on a powdered iron core.



4-400A Power Amplifier

The aluminum box holding the grid assembly and tube sockets is *6* x 6 x 14¼. It is made in two L sections. The one in the amplifier has one inch bendovers on all sides. The other half of box screw fastens to make the box airtight. A phenolic board 5 x 5 x ¼ holds the grid turret in place. The grid tuning capacitor shown at right is insulated from panel with a pair of phenolic washers. Note the co-ax junction in base, it permits operation with the micromatch coupling unit removed from the amplifier.

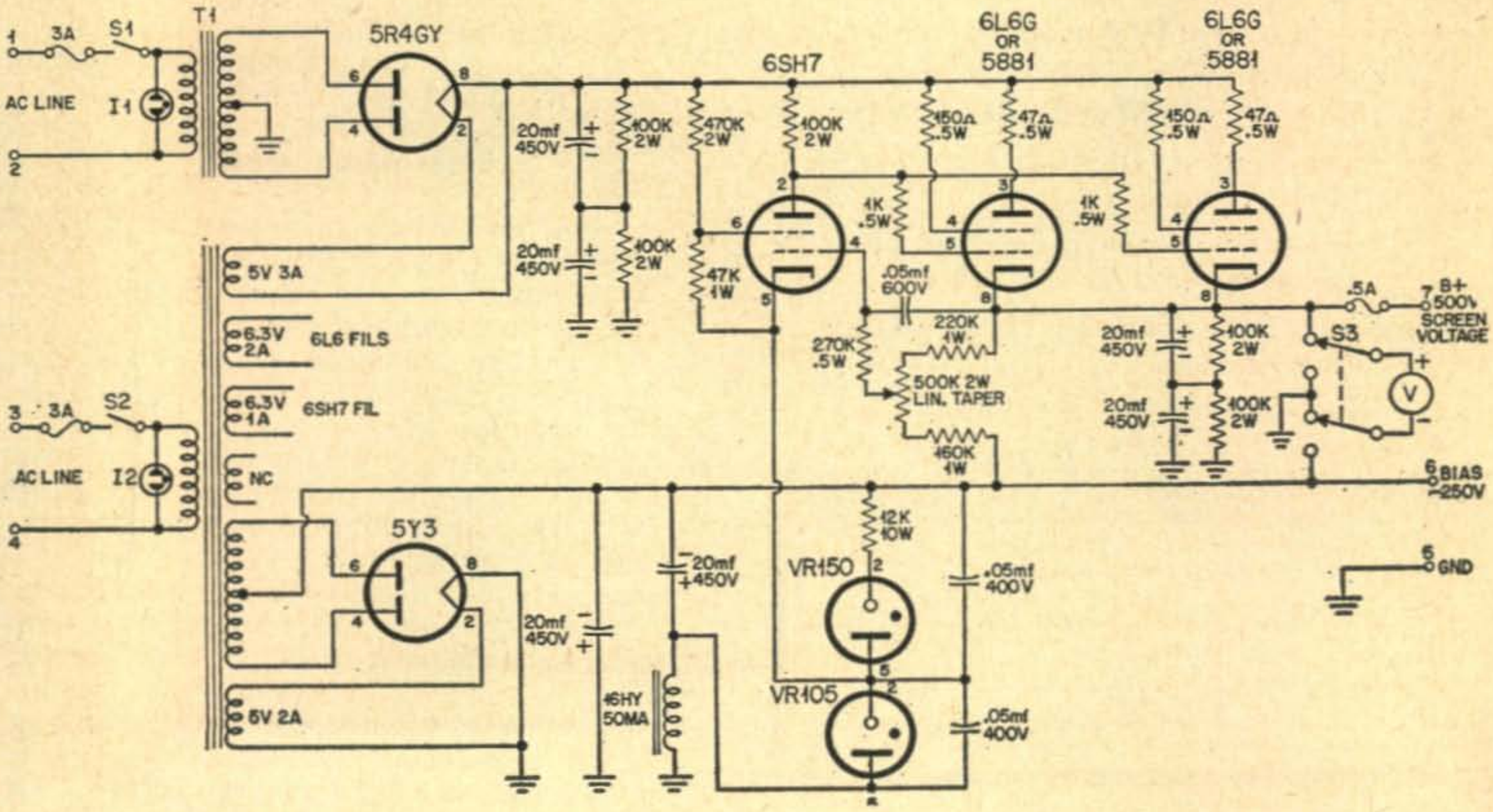


Schematic of 4-400 Kw high voltage power supply

choke input filter is used. The RX21A ratings fall midway between an 866A and an 872 and will handle 750 milli-amperes.

This power amplifier with its antenna selector switch deserves a few extra beams, but the small lot at my QTH just doesn't have the space. Now if some enterprising local real estate firm would run a contest for some hill-top acreage. ■

Schematic of the 4-400 Kw screen and bias supply



"Mage" Magers
WØOJI, President

NEW!

Here's VESTO'S New *Hurricane-Proof** TOWER

Completely self-supporting! Uses no guy wires! New hinged base allows you to assemble your Vesto tower on the ground and raise into upright position! Or assemble from ground up, a piece at a time!

TEN TOWER SIZES TO CHOOSE FROM:

22 ft. to 100 ft. Prices start at only $104. You Save By Buying From Vesto!
Small Down Payment—Easy Terms

LOOK AT VESTO'S FEATURES!

- 4-leg construction gives better balance and strength
- Steel ladder from ground to platform at top
- Safety platform with metal railing and trap door
- Heavy galvanized steel construction

*No Vesto tower has ever been damaged by hurricane!

Send Today for Complete FREE INFORMATION

VESTO COMPANY, INC., DEPT. CQ
20th & Clay, North Kansas City, Mo.

Name _____ Call _____

Address _____

City _____ State _____

For further infomation, check number 27 on page 206.

Station [*from page 139*]

- ☐ A logbook, a callbook and a timepiece and calendar. Keeping the log as required by law necessitates the latter two.
- ☐ A dummy-load. Common light bulbs serve admirably for this purpose. When calculating their resistance value bear in mind this value is that present when the bulbs are operating at normal brilliancy. At any lower value their resistance will be considerably less. For example, a 100-watt 120-volt bulb when cold measures about 17 ohms, compared to its calculated value of 144 ohms obtained using the formula

$$R = \frac{E^2}{W}.$$

Mobile Equipment

- ☐ A VFO-excited transmitter with means of accurately zero-beating.
- ☐ Fuses for protecting each component, and in addition a key-controlled master switch. Dead batteries as well as FCC rules regarding access to equipment make this provision desirable, particularly if you drive a convertible.
- ☐ A receiving system which includes Conelrad, muting while transmitting, and band-edge markings.
- ☐ A logbook, faithfully used and accurately maintained. Do this while stopped. Got a timepiece?
- ☐ Transmitter control which permits you to use both hands on the wheel. To do otherwise is dangerous, also illegal in most states. A footswitch or a toggle switch which requires only momentary use of one hand is dandy. Please, no more epitaphs that read:

> "He went sizzling down the highway,
> One hand held mike and switch;
> A truck pulled out in front of him:
> He didn't even twitch."

Emergency Gear

- ☐ An emergency power source that is *ready right now.*
- ☐ A dependable receiver and transmitter and all interconnecting cables.
- ☐ A complete radiating system, including feedline, ground wire and rod.
- ☐ Provision for light and heat, even if the latter consists of long-handles and cold-weather boots. I found out on Christmas Day, 1955 operating in a cold, clammy building with wet feet is *murder.*
- ☐ Necessary logging and message blanks, pencils, a list of net frequencies, plus Civil Defense and/or Red Cross identification for you and your car. When law enforcement agencies tighten up their control of an area proper identification will save time, temper and sometimes embarrassment. ■

Attention Club Bulletin Editors

Marvin D. Lipton, VE3DQX,
311 Rosemary Road,
Toronto 10, Ontario, Canada

Most Radio Club Bulletin editors are confronted with a common dilemma; the ever present problem of providing satisfactory copy for each issue of their respective publications. We offer a remedy for the many headaches that have been precipitated by publication worries. We are not selling Aspirin, but we are forming an Amateur Radio Club Newspaper Syndicate that will put gobs of news on the desk of every affiliated editor.

To register, you merely drop a note to us (address above) informing us that you wish to be placed on our list. You follow-up your initial memorandum with subsequent copies of your club bulletin each month. After we receive the monthly papers of all our syndicate editors, we shall extract news items of national interest from the various journals and transcribe these items onto one sheet. The sheet will then be circulated to all members of our news service. The local editor's hue and cry for news will no longer be heard.

Any individual or editor that writes an article that is capable of holding the interest of all Radio Amateurs would have his effort syndicated also. The more contributions we receive, the happier we shall be. Perhaps a Radio convention or other news event may come to your town. Such happenings would provide you with excellent topics to write on.

The progress of the news service will be reported in this column each month. If your club magazine is a gem, let us have a copy and we shall be glad to tell our readers how it functions, who runs it, etc. Please be sure to mail us your paper before the SIXTH of each month. Hope to hear from you soon. ■

QSL Contest

Your QSL card is the representative of you and your station in the other fellow's shack and as such it should be designed with care and should be something that you are proud to show and exchange. If you examine your QSL collection you will find that in almost every case the card you have received from a station reflects the character of the operator. The plain unimaginative card obviously comes from just such a person. The strikingly different card comes from the chap that you always enjoy meeting on the band. Does your card reflect your personality?

In the interest of making ham radio more fun we have been trying to create more interest in original QSL cards. Each month we scrutinize the cards sent in and designate the most interesting and original as the Winner (prize is a two year subscription to CQ). Other outstanding cards are given honorable mentions. ■

This month's winner is KN6ZDG, Petrolia, Calif. Honorable mentions for W2KJQ, Seaford, Long Island, New York; VE2AP, Quebec, Canada and K8BYN, Niles, Mich.

BARGAINS IN QUALITY CRYSTALS

Order your crystals from CRYSTALS, INC. Where you get ACCURACY, DEPENDABILITY, QUALITY, LOW PRICES and ONE DAY SERVICE.

AMATEUR BAND CRYSTALS

NOT SURPLUS! New quartz ground and etched to your EXACT SPECIFIED FREQUENCY. Checked on HP CYCLE COUNTERS. Mounted in surplus FT243 holders to save you money.

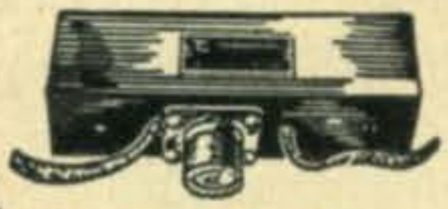
1500KC to 2000KC .....$2.00 ea. postpaid
2001KC to 8995KC .....$1.50 ea. "
8996KC to 11000KC .....$2.50 ea. "
Any above crystals in DC34-DC35 holders $1.00 extra

SSB FILTER CRYSTALS

Plated type in FT241A holders. All Channels 370KC to 534KC (except 500KC) 55¢ each postpaid. 500 KC—$1.25 postpaid.
Channel groups accurately matched—No Extra Charge.

SUPERIOR COMMERCIAL CRYSTALS

CRYSTALS, INC. can supply highest quality Commercial Crystals that meet all FCC standards—in a fraction of the time required elsewhere. Write call or wire your Commercial Crystal needs.



"IMPEDACOUPLER"
The ideal line connector for coax fed antennas

Weatherproof, strainproof, constant impedance. Takes standard coax connector. Amateur net postpaid....$4.95

Minimum Order $2.00 No C.O.D.s
Satisfaction guaranteed or your money back!
ILLINOIS ORDERS . . . Please include sales tax.

CRYSTALS INCORPORATED
ODELL, ILLINOIS

For further information, check number 28 on page 206.

Stolen as usual from

AUTOCALL

Wash. D. C. Mobile Radio Club

Every now and then we get squeezed for space in CQ and have to bump something . . . like the Puzzler last month. So, back to business. There were four problems in the September issue . . . well, three anyway. #1 was easy, but dirty. He was a midget and couldn't reach the elevator button for the 20th floor so he pushed 18 and walked the rest of the way. #2: They started with $39, $21, and $12. #3: 36.

Now, to get you on the hook again, here are some more Let's start easy, eh? No. 1: You have a box of 6-32 nuts and place them in three piles. In the first pile place one-sixth of the nuts, in the second place a certain number of fifths, which leaves six nuts for the third pile. How many did we have?

And No. 2:

```
* * ) * 9 * * * ( * * *
       * *
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       * * *
       * * *
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         2 * *
         * * *
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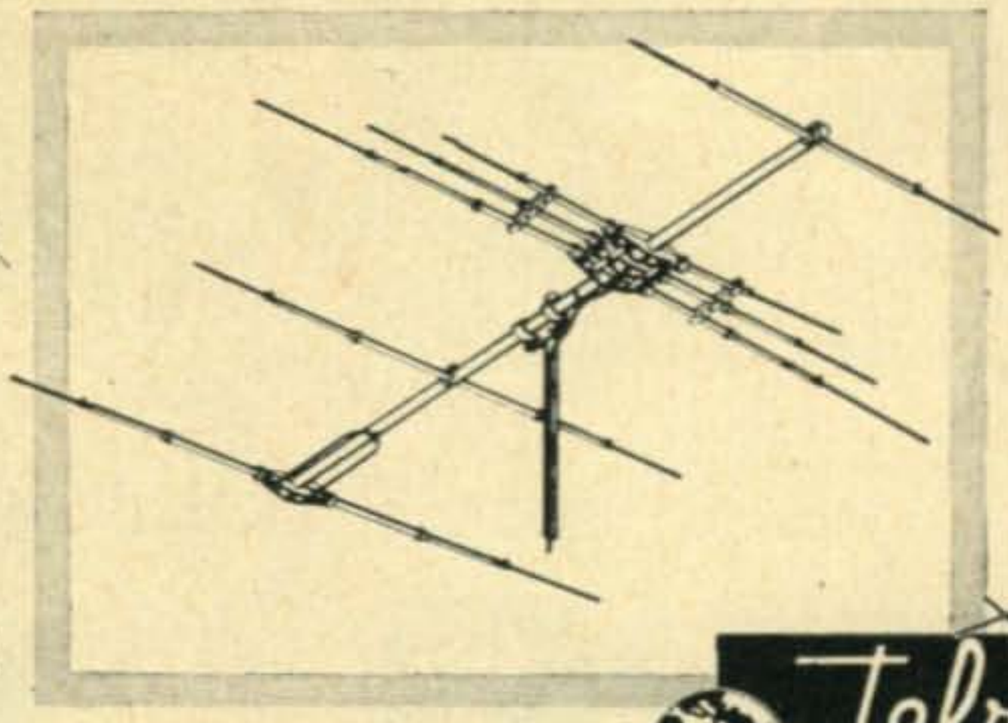
Rest up on No. 3. If you screw an electric bulb into a socket by turning the bulb toward the right with your right hand, which way would you turn the socket with your left hand to unscrew it while holding the bulb stationary?

Tired of formulas and living on ur roof?
Wanna enjoy ur hobby and live-a-little too?



If so, latch onto and install a TELREX TB2E-10-15-20. It's the only no-compromise one-transmission line "Tri-Band"® providing satisfying *top-man-on-the-frequency results* on 3-bands with a genuine gain of 5.5 db and a F/B ratio of 19 db, without traps to break down, or tricks and formulas to fiddle with!

How much for TOP PERFORMANCE AND THE FINEST MATERIALS, TOO? ONLY $158.00 f.o.b. AP.—N.J.
Wanna write instead? Complete Teck. info. free!

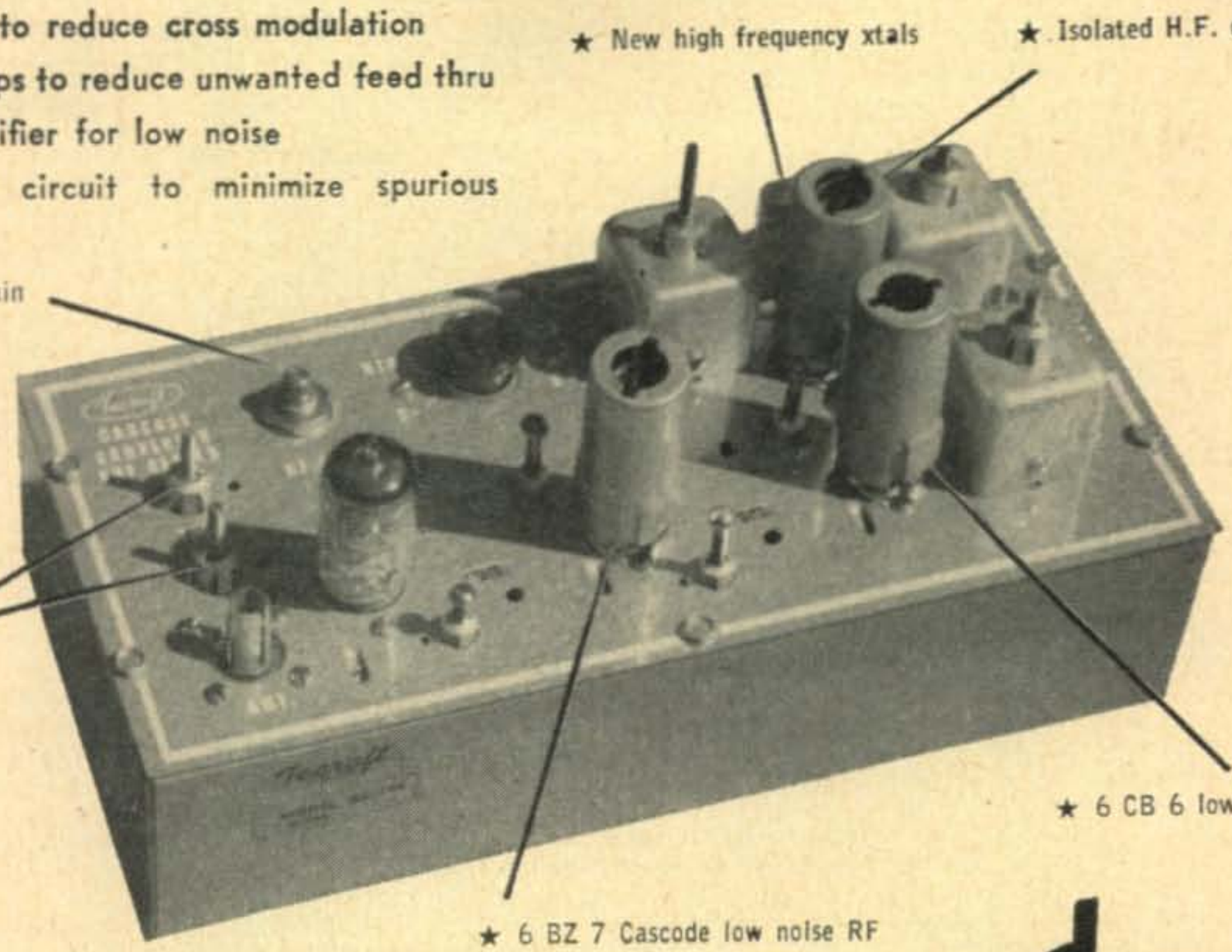
ASBURY PARK 2, NEW JERSEY
Telephone: PRospect 5-7252

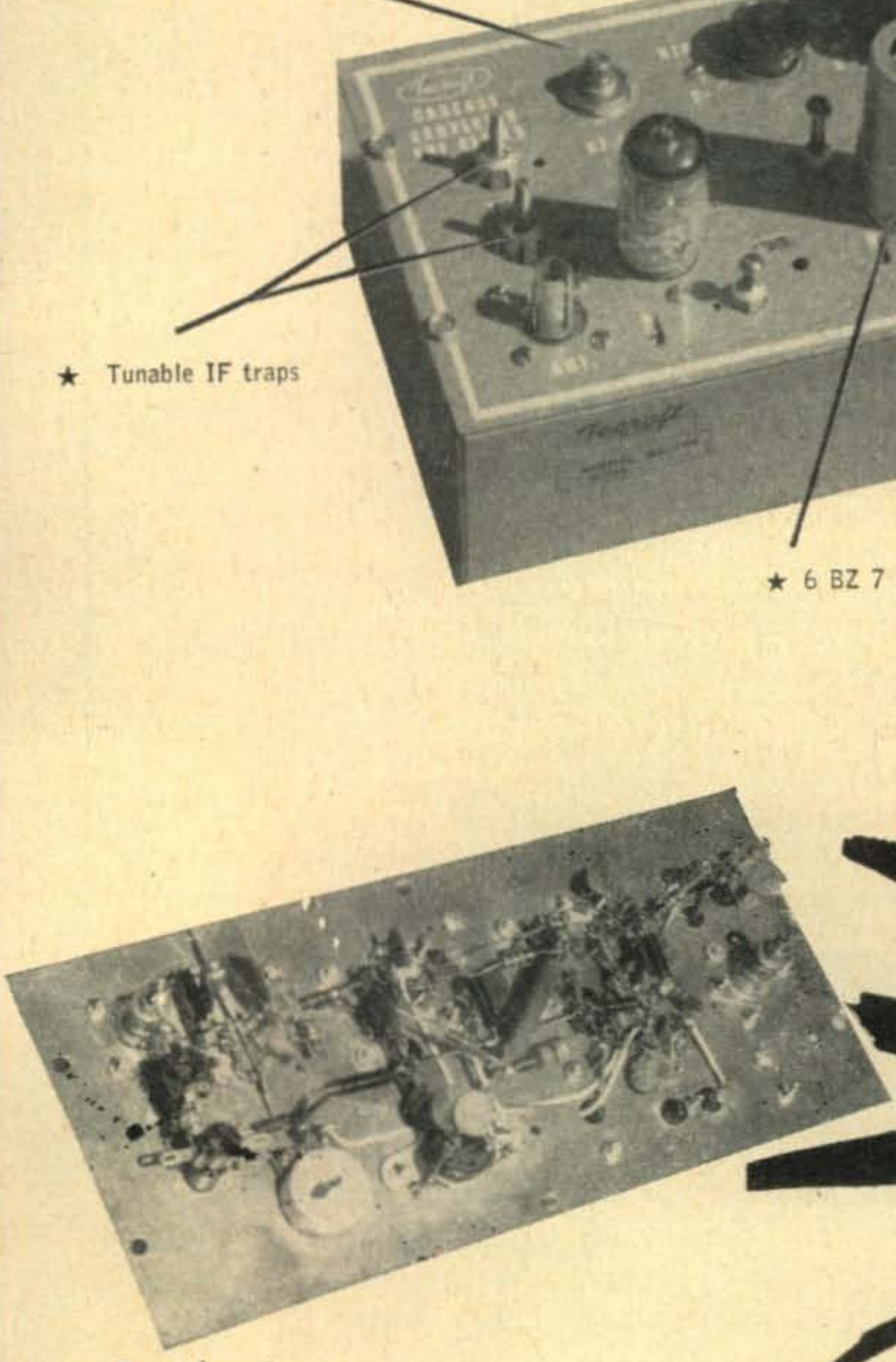
telrex LABS
TV & COMMUNICATION ANTENNAS

For further information, check number 29 on page 206.

Here are the All New Tecraft de luxe Cascode & 6 Meter Converters

A new concept in VHF converters
★ Variable R.F. Gain to reduce cross modulation
★ Tunable antenna traps to reduce unwanted feed thru
★ Cascode R.F. Amplifier for low noise
★ Isolated oscillator circuit to minimize spurious response





$44.95

Design Considerations:
Sensitivity—(2 Meters) 1 mu 30% mod. signal gives 6 db over noise
Low noise—(2 Meters) 4 db (optimum noise figure for max. sensitivity)
Rejection of spurious responses
Freedom of overload—(cross modulation)
Low cost

Tecraft

At Your Dealer, or Write

THE EQUIPMENT CRAFTERS, INC.
523 WINNIE AVE., RIVER EDGE, NEW JERSEY

For further information, check number 15 on page 206.

Contest [*from page 196*]

successful that it was decided to make it a contest. For full details see our next issue.

DARC WAEDC

This year the DL/DJ gang have cut their contest time down to one week end for each section. With so much contest activity now on the calendar, we think this was a wise move.

CW operation will be on 5 bands; 10 thru 80, with QTC traffic like in last year's contest. Phone will be confined to only 3 bands; 10, 15 and 20, with no QTC traffic. Full rules in our December issue.

That's all for this month fellows. Don't forget, four trophies will be awarded in this year's contest. One for the highest Phone All Band, Single Operator score, donated by W2IOP. One for the highest CW All Band, Single Operator score, donated by W2SKE. One for the highest Phone All Band, Multi Operator score, donated by K2AAA and one for the highest CW All Band, Multi Operator score donated by K2GL. Good luck and see you pile-up the last week end in November.

73, Frank, W1WY

Statement of Ownership

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF CQ, published monthly at New York, N. Y. for October 1, 1957.

1. The names and addresses of the publisher, editor and business manager are: Publisher: Sanford R. Cowan, 6 Embassy Court, Great Neck, N.Y.; Editor: Wayne Green 300 West 43rd St., New York 36, N.Y.; Managing Editor; none; Business Manager, David Saltman, 1878 Harrison Ave., New York 53, N.Y.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address as well as that of each individual member must be given.) Cowan Publishing Corp., 300 West 43rd St., New York 36, N.Y.; Sanford R. Cowan, 6 Embassy Court, Great Neck, N.Y.

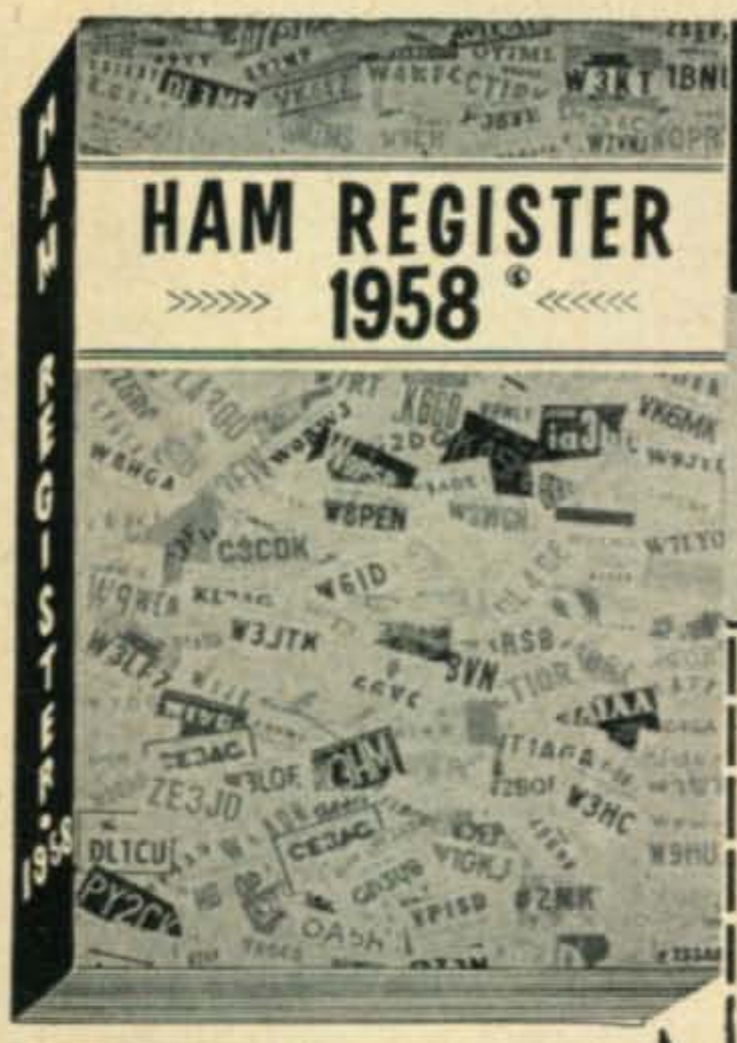
3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and beliefs as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

(Signed) David Saltman, Business Mgr.

Sworn to and subscribed before me, this 20th day of September, 1957.

WILLIAM M. FORGIONE, Notary Public
(commission expires March 30, 1959)



NOW AVAILABLE

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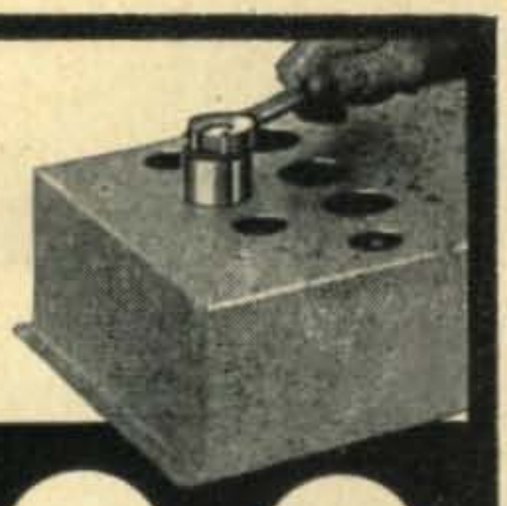

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Smooth, accurate openings made in 1½ minutes or less with Greenlee Radio Chassis Punch

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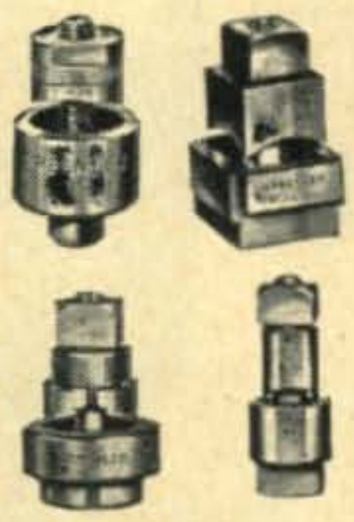

GREENLEE

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- Public Address Systems
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Limpander LIMITER-EXPANDER Model LE-2

Electronic Systems Engineering Co.
903 Cravens Building, Oklahoma City, Oklahoma.

For further information, check number 34 on page 206.

The Regency Transistor Converter

Wayne Green, W2NSD

This gadget has been around for several months, but for some reason I just got my hands on one the other day. I have been wondering whether it was any good . . . just what kind of sensitivity and selectivity you could get with such a small contraption.

Before I get into the gory details of my testing (?) let's see what it is all about. The main feature of the ATC-1 is its size: 4¾" x 3½" x 4¼," a mightly small handful. Weight is 30 ounces. The power supply consists of three penlight cells which plug into the back of the unit (confounded cells cost 15¢ each these days, used to be a nickle). There are two jacks in the back, one to plug the antenna into and the other connects to the receiver. If you are going to use it in the car (a good idea) the installation only takes a couple of seconds since the car antenna plugs right into the ATC-1 and the supplied cable plugs into the car receiver.

There are five controls on the converter: band switch, tuning, antenna trimmer, Q-Multiplier, and mode switch (off-AM-CW/SSB). The five regular amateur bands are covered with full band-spread tuning, like the G-66, NC-300, etc. The Q-Multiplier provides for variable selectivity plus BFO for cw and SB. So much for that, now . . . how does it work? Well, I tried it with three different broadcast sets. First I plugged it into the radio in the car, tuned to the 1200 kc output of the ATC-1 and tuned the bands. Say, you know this thing really works. An NC-300 it isn't, but it certainly compared favorably with some of the cheaper receivers I have run into recently.

Next I connected it into a small broadcast set in the house and got a heck of a kick out of having, essentially, a complete communications receiver in my hand. It worked! I tuned in the phone and CW signals easily . . . and even got fairly expert at unscrambling the SB gang.

My final test was with the Regency transistor broadcast receiver. I didn't expect to get much from this since there was no mention of this combination in the literature . . . and if it worked I couldn't imagine them keeping still about it. Sure enough, it didn't work. I wrapped a few turns of wire around the antenna coil of the BC set and hooked it in, but the gain was too low for any but the really strong signals to pump through. I could hear all the locals fine, but the UA's were weak, verrry weak. So, back to the car with it where it really pulls 'em through.

You can bet that I'll take this pocket (?) communications converter with me on all trips so's I can keep an ear peeled on the bands. Now, if only someone would come up with a rig that size! ■

these fine

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NC-109

A modern, low-cost receiver with an exclusive "Microtome" crystal filter and separate product detector for CW and SSB reception. Includes large "S" meter, 4-band coverage (540 kc. - 40 mc.), voice, CW or SSB reception. Bandspread calibrated for 10-80M. 11" lucite slide-rule dial, accessory socket for external adapters and other accessory devices. 11 tubes including rectifier and voltage regulator. Two tone metal cabinet with chrome trim measures 16-13/16 x 10 x 10-7/8". Weight: 35 lbs.

Only $16.20 per mo.

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A top-quality, low-cost receiver, directly calibrated for the 4 general coverage ranges and 5 bandspread ranges for the amateur bands (80-10M). Also covers 540 kc. to 40 mc.; voice or CW. Features include calibrated bandspread for 10, 11, 15, 20, 40 and 80M; separate tuning capacitors, knobs and scales for general coverage and bandspread; large easy-to-read 11" slide-rule dial, and front panel "S" meter for signal strength indication and more accurate tuning. Size: 16-13/16 x 10 x 10-7/8".

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For further information, check number 32 on page 206.

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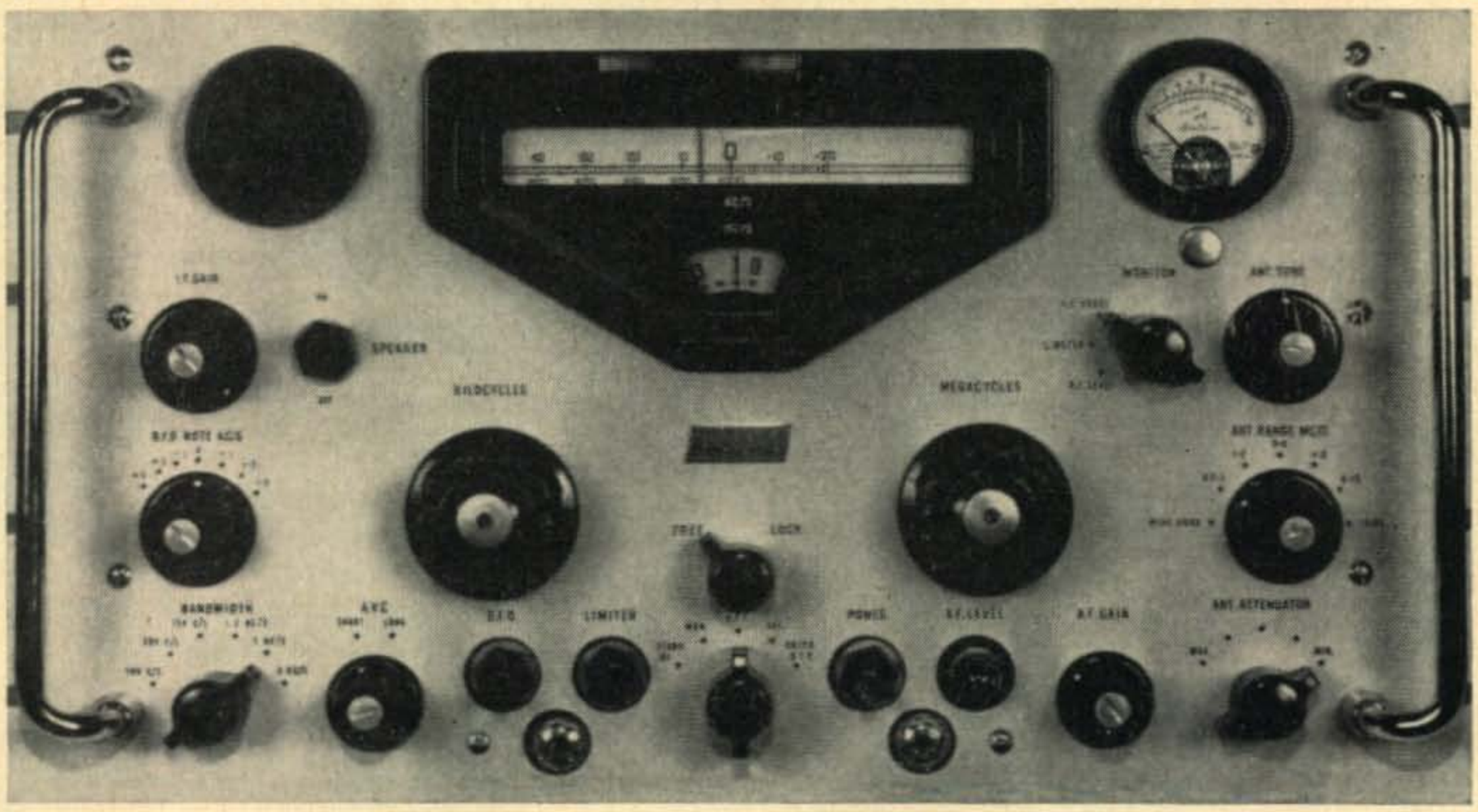
NEW DISCOVERY:

ELECTRONIC BAND SWITCHING • ELIMINATES SWITCH CONTACTS



Electronic Band Switching . . . a new discovery . . . makes for extreme stability by eliminating the usual switch contacts, complex gear trains and their backlash, and permitting much simpler mechanical construction.

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Tunes from 500 kc to 30mc in 30 bands, with an adapter available to extend the range down to 12.5 kc. Each band covers over 60 inches of dial, giving over 6" tuning for each 100 kc band . . . the widest bandspread ever provided by a communications receiver! With this bandspread it is simple to set the dial within 200 cycles of a desired frequency.

- **Extreme sensitivity: 3μv for 20 db S/N ratio (30% modulation)**
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- **Crystal calibrator built in**
- **Built-in loudspeaker plus three separate outputs for external speakers**
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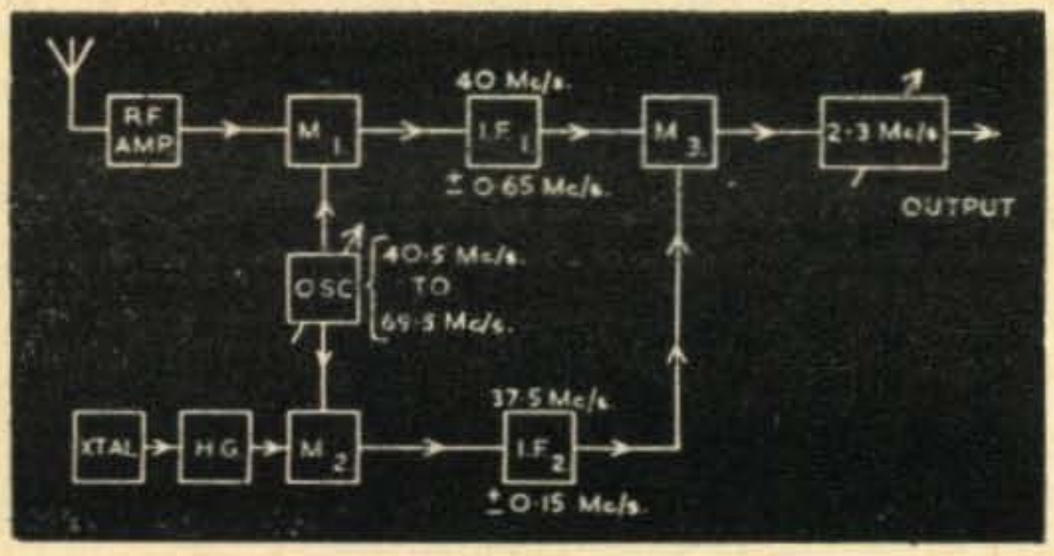
- **Very low re-radiation, negligible spurious responses and low cross modulation**
- **Cast chassis for rigidity and stability**
- **Plus scads of other features**



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For further infomation, check number 35 on page 206.

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a ten inch aluminum wonder-disc

Give your Mobile up to 20% increase in radiation. Improves any Mobile signal. Fits any standard antenna, special model for fiberglass whips (on request). Makes whip tunable over entire band, simply move hat up or down whip to change frequency. Allen wrench supplied.

Aero-dynamically designed for minimum antenna sway. To retain antenna resonance with the Capacihat turns must be removed from the antenna coil. The power normally lost in these removed turns is then radiated into the air instead of burned up in the coil.

Order now, only $3.00 each cash, check or money order.

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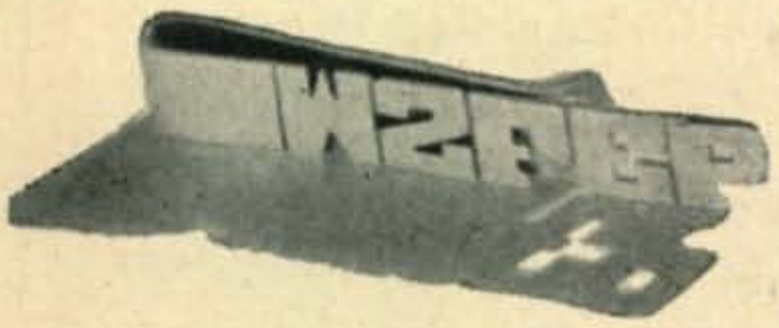

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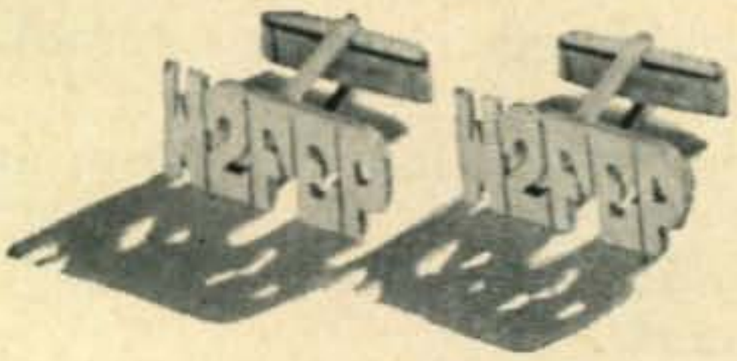

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Order yours now to insure delivery before Christmas "and don't forget that ham buddy of yours"

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For further information, check number 37 on page 206.

Phony? [from page 121]

(often with his own equipment too!) he had become the most valuable asset to his nation in time of peril. In the first World War the story was the same on a smaller scale, and the history of ham radio will reveal cases of old time hams tracking down enemy radio stations located in the USA.

And now, visit any of these hams of yesteryear and you will find that gatherer of tin foil and stolen window panes, and the man who robbed the copper tank from the flush toilet in a vacant house in order that he could build a two inch copper ribbon spark oscillation transformer; all of them are using commercial equipment, some completely, others partially. Commercially manufactured receivers are in use almost without exception. The urge to change a receiver is never as frequent as the building of a new transmitter, or some different type of antenna.

The receiver situation is virtually static; a good receiver will select and deliver signals to your satisfaction, and there the matter ends. With the transmitter it's somewhat different; many still build for a better signal, but most of the old time transmitter, receiver, and measuring equipment builders know when they are licked.

Firstly, the allotted span of life left to a large number of two letter call holders is fast running out for the time it takes to build a 15 tube receiver, or a TV-proof, complex, all-band switching transmitter.

Secondly, no ham can ever hope to build a rig like the jobs turned out by commercial firms who have a million dollar testing laboratory staffed with superbly trained radio engineers. Untold millions were poured into such plants for war purposes, and the product *had* to be *good;* money was no object. One transmitter these folks made for Air Force in the last war cost the taxpayers $1,200.00 each.

After the war I bought one, ready to go on the air, for the price of $28.00. It's a VFO job, zero drift from a cold start, and no TVI. It's been on the air steady for years, running around 1500 QSOs per year with no trouble whatever.

As a final parting shot to the fellows moaning *cheater, phony,* and *the hobby's gone commercial.* Those fellows don't seem to have priced the parts for a complex item of Amateur gear. Then when the thing is built there would be months of chasing bugs out of it before it would work anything like the commercial transmitter mentioned above.

So—if you don't want to admit you are licked and have lots of money, months of spare time to work at your hobby, there is nothing stopping you from still qualifying as an Amateur Radio Constructor. ■

1. Do you wish to extend your experience in electronics systems?

2. Would you like to instruct others in advanced fire control systems and laboratory techniques?

3. Would you like to handle a responsible position representing a leading electronics organization?

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5. Are you interested in analog computers, digital computers, power supplies, transmitters, receivers, and microwave antennas?

6. Do you enjoy working with people?

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For further information, check number 38 on page 206.

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3. Cut out this whole box and mail it to: CQ Magazine, 300 W. 43 St., New York 36, N. Y.

Halo

[*from page 115*]

type QSOs while in motion not only on the Cape but also in the more hilly Boston area. Notably with W1DBH in Arlington, Mass. who picked us up 15 miles out and talked us all the way into our Boston doorstep despite bridges, gas tanks, city buildings, and such. Also with W1UBF in Whitman, Mass. and with W1CUY in Plymouth, Mass. who remotely directed us through some tricky twists and turns to a destination in that town.

Epilogue

While on Cape Cod we had the pleasure of giving the novice exam to Parker Boggs, the young son of the folks we visited. Three weeks later he got his ticket, KN1CZS. On the second of August we made another trip to Falmouth and set up the halo and the Gonset for his temporary use. His second QSO was with WN2MFC in Neptune, New Jersey, better than 200 miles. SSW

Valedictory Notes

(a) Admittedly this halo is no triumph of precise design. Anyone who wants to can go ahead and optimize it. He can engineer th' be-jeebers out of it and maybe come up with an extra db or two. One of the learned brethren blandly remarked: "So the band was open and you had an antenna and you worked people." He is so right; we had an antenna!

(b) Symmetry, regular spacing, and exact dimensions are to be desired but may not be too important operationally. The halo's slightly dizzy appearance in the photograph is due to the fact that we caught it on a low-hanging branch while under way. It ripped the branch right off the tree, buckled the ¾ inch mast, and reduced the halo to the semblence of a pretzel. We just bent things back into approximate shape and carried on. This happened, by the way, before the second trip to Falmouth. It still works fine.

(c) The RCA coils were designed for TV reception and are wound with mighty small wire. They live quite happily with the Gonset Communicator but for transmitters of significantly higher power it might be well to make up a huskier set. See any recent edition of the Radio Amateur's Handbook under "Baluns."

(d) On Sat., Aug 24, 6:50 PM EDT was QSO W3ASD, Smyrna, Del. while mobile with Halo and Gonset just South of Boston, Mass. Distance 350 miles!!

(e) The distances mentioned are string-distances taken from road maps. They are probably OK within 10%.

(f) THROW AWAY THOSE BUGGY WHIPS, BOYS! THE HORSE AIN'T NEVER GONNA COME BACK. ■

JUST RECEIVED! ASB-5 'SCOPE INDICATOR

BRAND NEW, including all tubes together with 5BP1 'Scope Tube. Originally used in Navy Aircraft Radar Equipment. Easily converted for AC operation. Value $250.00!

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BC-929 3" SCOPE INDICATOR COMPLETE

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BRAND NEW

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Complete set of 10 Plugs for BC-645..... **$5.50**

CONTROL BOX for above..... $2.25

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Cavity type, 145 to 235 Mc. BRAND NEW in original factory packing, complete with antenna. Manual included.
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RANGE BEAM FILTER 1020 cycle acceptance or rejection. With PL55 Cord and Plug..... **$1.95**
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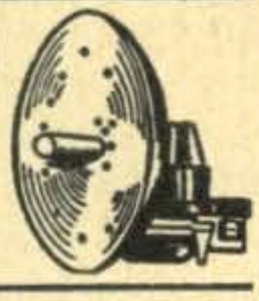

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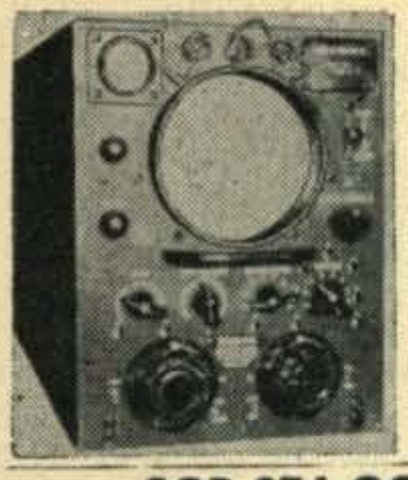

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Navy Type Comm. Receiver 1.5 to 3 Mc. BRAND NEW with 6 tubes..... **$16.95**

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Telephone: CO 7-4605
53 Vesey St., New York 7, N. Y.

NEW!

SIZE: 1⅜" x 1⅜" x 2¾"

with a performance rating never before possible.

DOW-KEY

ANTENNA SWITCH

MODEL DKC-TR

The DKC-TR features a gain of Zero db at 60 mc to plus 6 db at 3.5 mc. Can be close-coupled to the transmitter for easy, compact installation with a Dow DKF-2 connector. Instantaneous recovery powered from transmitter accessory terminal. Matches 52 & 72 ohm impedance without insertion loss. Handles one KW with ease.

POWER SPECS: B plus 125-150 volts, consumption at 125 volts, 6.2 mils; .450 amps at 6.3 volts; uses 6AH6 tube.

GUARANTEED! Fully backed by factory warranty for unit replacement.

DOUBLE MALE-CONNECTOR (DKF2) for mounting relay directly onto output of transmitter.

See your local electronics dealer or write direct for complete specifications.

PRICE, $12.50
(price subject to change without notice)

DOW KEY CO., INC.

WARREN, MINNESOTA

For further information, check number 41 on page 206.

TELEWRITER CONVERTER

FOR RECEIVING

RADIO TELETYPE

To receive amateur or commercial teletyped messages by radio, you need the following equipment: (1) Good communications receiver. (2) A TELEWRITER CONVERTER which plugs into the receiver phone jack. (3) A Polar Relay which plugs into the back of the Telewriter Converter. (4) A small 12 volt, 60 ma. d.c. power supply, to operate the selecting magnet(s) in the teleprinter machine. (5) A teleprinter (teletype) machine, which is an electric typewriter controlled by radio signals. (Used teletype machines are available from $75 up.) Telewriter Converter $89.50. Polar Relay $14.75. For additional information write: Tom, W1AFN.

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2, 6, 10 — Meter

MOBILE EQUIPMENT

MOTOROLA, R.C.A., G.E., LINK, etc. 30-50 Mc., 152-172 Mc. Used Commerical F.M. Communications Equipment Bought & Sold. Complete two-way sets meeting F.C.C. Licensing Requirements for taxicabs, Police, Fire, etc. **$169.00** and up.

Motorola F.M. Receivers, Double Conversion ..... **$55.00** each

Motorola F.M. Transmitters ..... **45.00** each

COMMUNICATIONS ASSOCIATES

267 Washington Street, Dorchester, Mass.
Telephone: AVenue 2-8088

Vertical [*from page 69*]

supports except the one at the base which is aluminum and provides the electrical connection for the added antennas. The supports are connected to the 40 meter vertical with TV antenna hardware. In my case I used bakelite strips for the upper supports and merely bolted the elements to them. Construction of the support brackets can be seen in *fig 2*.

Antenna lengths should be taken from the Handbook to enable the builder to get best results in the parts of the bands intended to be used most frequently. Lengths given in *fig 1* are approximately for the centers of the bands taking into consideration the 4 inches added by the metal base support for the 10 and 20 meter verticals in my installation. The lengths would vary with the type of construction and the spacing between antennas.

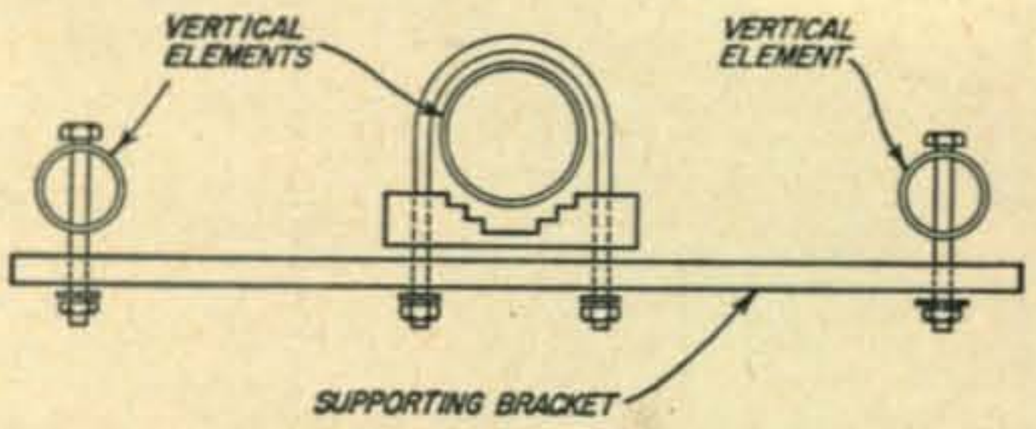

Fig 2. Construction of the supporting brackets as "D" used at W6CVW. The horizontal cross member as shown in Fig. 1 is made of aluminum for the base and an insulating material for the remainder.

The s.w.r. was reasonably low with the element sizes and RG-8-U co-ax used here. Field strength meter readings revealed a marked increase in low angle radiation on 10 and 20 meters compared to the 40 meter vertical alone as a radiator on these bands.

The 40 meter drooping radials seem to suffice for all bands, but it is conceivable that some improvement would result in adding 10 and 20 meter radials in parallel with the ones for 40 and making them 2.5 percent longer than the vertical elements. I can't see where this added refinement would be of much advantage where buried or grounded radials are used.

In cases where the base of the antenna is not very high it would be worth while to raise the maximum current portion of the 10 meter and possibly the 20 meter antennas. This can be done quite easily by making the radiators 5/16 wavelength long instead of 1/4 wave and series resonating the antennas at the base with variable condensers. A 50 $\mu\mu$fd variable will do for the 10 meter antenna and about 75 $\mu\mu$fd should handle the 20 meter radiator. The lengths would be approximately 10 and 20 feet respectfully.

Naturally many improvements can be made on this basic idea and although no provision was made for 80 meters I felt that the added usefulness of my 40 meter vertical was well worth the time spent on the modifications. ■

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NEW LOW PRICES! — EFFECTIVE NOVEMBER 1st

COMMAND TRANSMITTERS & RECEIVERS

ARC-5 and SCR274 as available

BC 455

XLNT... $5.95

Depot Repacks... $7.95

Receivers, w/o dynamotors

R-25 Marine, 1.5-3 MC, new $10.95
R-26 or BC-454, 3-6 MC, used $6.95. Depot Repacks 7.95
R-27 or BC-455, 6-9.1 Mc, used $5.95. Depot Repacks 7.95
R-28, 100-156 MC, Exlt 13.95
R-4/ARR-2, 234-258 MC, as is w/o tubes, $2.95, w/tubes, used 4.95
Receiver Spinner Knobs ..... ea. .69

Transmitters, w/o modulator or dynamotor

T-18 Marine, 2.1-3 Mc, as is, w/tubes, 3.95, used 4.95, boxed 7.95
T-19, 3-4 Mc, as is w/tubes, 6.95, used 7.95, new 8.95
T-20 or BC-457, 4-5.3 Mc, as is w/tubes, 2.95, used 3.95 boxed 5.95
T-21 or BC458, 5.3-7 Mc, as is, w/tubes, 2.95, used 3.95, boxed by depot 4.95
T-22 or BC-459, 7-9.1 Mc, as is, w/tubes 3.95, used 5.95, boxed 8.95
T-23, 100-156 Mc, xmitter used, 13.95, xlnt 14.95
Special—1 R-28 Rec. & 1 T-23 xmitter both 25.95

Misc. Command Equipment as available

Receiver dynamotors 28V, used ..... $ 1.00
BC-456 SC Mod. w/tubes, new 4.95, used 3.95
MD-7 ARC-5 Pl Mod w/tubes less dyn. Xlnt 8.95
28 v dynamotors for above unit 3.00
3-Rec. Rack, new 2.49
C38 ARC-5 Control Box ..... Xlnt 1.49
C30 ARC-5 Control Box ..... New 4.50
Radio Compass Ind. I82A With Selsyn ..... New 8.95
12V Relay DPST ..... New 2.49
New 24V Trans. 1A 3.50
Plugs for rear of receiver 1.00

110 VAC power supply for ARC-5 & 274N Recvrs kit 8.95, Wired & tested 12.95

Receiver Conversion kit: cont. schematic, BFO Sw, 25 K Pot. phone jack and knob, with instructions 1.95

1625 Tubes, for trans # mod, 50¢ 3/1.00

POWER DRIVEN ANTENNA REEL

½ HP G.E. Motor—12-24 V. Removable 6" Reel. Cam worm gears, bevel gear, Solenoid clutch. In gear only when current on. Operates clockwise or counter clockwise. Ideal for power fish line, opening or closing doors, auxiliary power take-off. Can be used as buffing machine or for dozen of other uses. Weight 6 Lbs. ..... New **$4.95**

Popular Dynamotor Specials

DM-34 Recvr. Dyna. 12 V in 220 @ 80 ma out. new 4.95
DM-42, 12 V in. out 1000 and 500, ea at 215 Ma. used 12.95
DM-35, 12V in. 600 at 200 Ma out. Xlnt 12.95
Wincharger Dyna. 12 v in 440 @ 200 MA Out, new 12.95
BD-69 Rec. Dyna. 14 v in, 220 at 80 MA out, new 9.95
PE-73, 24 v in 1000 at 350 Ma. out. New 8.95, used 6.95

BC-357 Radio Beacon Receiver

62-80 Mc. radio controlled receiver. Contains 10,000 ohm plate relay. Power requirements are 24 V. AC. @ .5 Amps. and 220 V. DC. @ 20 Ma. Swell for Garage Door Opener, Receiver, and other remote control installations. Brand New **$4.95**

12 V Heavy Duty Solenoid. New ..... $ 1.49
5763 Tube. New ..... $1.25 ea. 3 for $3.50
815 Tubes. New ..... $1.49 ea. 2 for $2.75
826 Tubes. New ..... 89¢ ea. 3 for $2.00
BC-654 Transceiver: 3800 to 5800 KC ..... Used: $34.95

Cathode Ray Tubes

5HP4 or 5CP1 ..... New 1.98
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WESTON—SANGAMO

METERS. ALL NEW 2" SQUARE

0-2 Ma, 0-5 Ma, 0-15 Ma, 0-50 Ma, 0-100 Ma, 0-200 Ma, 0-300 Ma, 0-500 Ma, 0-20 VDC, 0-40 VDC, 0-300 VDC

$3.29 ea. SPECIAL 3 for $9.00

Heavy Duty Collins choke 4 Hy-300 Ma can take 500 Ma peaks. new 3.95

Bantam 1-watter, BC-746 plug-in transmitter tuning unit from WALKIE TALKIE. 140 mmfd APC type variable cond. plus assorted parts including chassis. Builds into low power transmitter (See CQ March '54) ..... New, $1.29

OIL CONDENSERS

2 mfd 5000 vdc new $5.95
2 mfd 1000 vdc new 1.95
10 mfd 600 vdc new 1.49
8 mfd 600 vdc new 1.49
4 mfd 600 vdc new 3 for 1.00
2 mfd 600 vdc new 3 for 59¢

Mobile Microphones, newly assembled, W.E. D173015 similar to the TC-128, push-to-talk switch, 3 cond. 5' curl. cord, new **$3.95**

Chest Mike T-26 w/F1 Button. New $1.49
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RT-48A/TPX-1 IFF Trans-receiver 157-167MC. Complete with Tubes, used, xlnt. Makes nice 2 Meter Rig $12.95
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Brand New Headphones, HS-23, 2000 ohms, $3.95. HS-33, 600 ohms, complete with brand new rubber cushions **$4.95**

New small cushions, pr. ..... .49
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New lg rubber cushions, pr. ..... .29

Brand new impedance matching transformer, plug in, 2000 ohms to 600 ohms, takes std plug. boxed 69¢ each, 3 for **$1.95**

CD-307A cords, has JK-26 on one end for phones, std plug other end ..... **$ .97**

Stewart Warner Ammeter, 60-0-60 Amps, brand new, 95¢, 6 for 5.00
Phone-CW Filters, 1020 cycles, new, FL-5, 69¢ FL-8 with switch 1.89
GP-7 transmitter with all tubes less 803 tubes with 80 meter coil unit only 13.95
less tubes and coil unit 7.95
TU-7, 4.5-6.2 MC; TU-8, 6.2-7.7 Mc; TU-9, 7.7-10 MC; TU-10, 10-12.5 MC; TU-26, 200-500 Kc, choice, used, for BC-375 transmitter, each 2.29
T-30 Throat Mikes, used, 5 for 1.00
3' Mast Sections, MS-49 thru 52, 50¢ each. 53 and above, 75¢ each. Special 1 each MS-49 thru 54, makes 18' vertical 2.95

MN-26C direction finding Equipment
MN-26C Receiver w. dyna 14.95
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MN-52H Az Cont Box 2.95
All above new, special, 1 each for 21.95

Antenna Insulators, Bendix MT-48C, plated end caps, new 15¢ ea., 10 for 1.25
Control Box w/5 Ma S meter, special 1.98
SCR-522, exc. condition. Contains Receiver, Transmitter, Modulator, tubes, tunes 100-156 MC, covers 2 m w/o modification 29.50
522 Control Box—BC602 ..... New 4.50
New transmitters, GF-11 for 12 volts, or GF 12 for 24 volts, with tubes and built in modulator—less tuning unit, GF-11 $8.95 ..... GF-12 8.95
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Used W/One Tuning Unit 18.95
Right Angle Coax Connectors. Type M-359 and M-359A (83-1AP) ..... .29

TG34 or TG10, 1 Hour Code Tapes

No. 10, No. 13 ..... New, ea. 1.25

2.00 Minimum Order. All prices Subject to Change without Notice. Canada & Mexico minimum 10.00. Cash with Order. Sorry, no COD. California Orders Include 4% tax. Prices FOB Los Angeles.

SAM'S SURPLUS, 1306 Bond St., Los Angeles 15, California

For further information, check number 42 on page 206.

GOOD BUYS — ALL NEW

TRANSFORMERS . . . all have 115v, 60 cy. primaries Scope special; 6.3v/1.8 a; 6.3/0.6; 700 ct/30 ma; 525/5 ma; 2.5/1.75; 6.3/0.6; 2000 and 3500 volts insulation; upright double shell type . . . 5 pounds $3.45
1000 v/30 ma; 6.3/0.5; HS . . . 7 pounds . . . $1.69 ... 2/$2.95
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6.3 vct/4.4 amps; hermetically sealed . . . 4 pounds $1.79
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6.3 v/1 amp; HV ins; Thordarson T48850 . . . 3 lbs. $1.45
120 vct/10 mils; 120 vct/10 mils; HS . . . 1 lb. ..... 3/$2.45

FILTER CHOKES . . . all are potted types 10 hy/500 ma; 100 ohm; 2000 v RMS test . . . 30 lbs. $6.95
Dual 2.2 hy/550 ma; 27 ohm; 2500 RMS . . . 40 lbs. ... $6.95
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ELECTROLYTIC CAPACITORS . . . all are can type tubulars Special dual 8/450; no mounting ..... 4 oz. 6/95c
Triple 20/400; octal plug in type ..... 4 oz. 2/95c
Triple 100/35; clamp mounting incl. ..... 4 oz. 3/95c
Dual 20 mfd/450 volt; 1-hole mounting ..... 6 oz. 3/95c
80/450; octal plug-in type ..... 6 oz. 2/95c

CATHODE RAY TUBES 5JP2 . . . $3.45 3BP1 . . . $1.75
5GP1/5BP1XXX . . . $2.45; 3FP7 . . . $1.00 postpaid;
5FP7 . . . $1.19 postpaid . . . 7BP7 . . . $3.95

MISCELLANEOUS . . . all are excellent bargains . . . try some! 456 KC IFs; single air-trimmed ceramic ... 8 oz. 2/95c
6 pole; 3 position phenolic rotary switch ..... 3 oz. 4/95c
Ohmite AB; CU-1031 linear; 10 K ohm ..... 2 oz. ... 2/$1.19

MORE TRANSFORMERS . . . these have 220 volt primaries Filament; 10 vct/20 amps; primary and secondary taps allow range of 6 to 12 volts ..... 25 pounds $2.95
Plate; 1160 vct/710 mils; open frame ..... 60 lbs. $17.45

WRITE FOR FREE GOVERNMENT SURPLUS BARGAIN BULLETIN

All prices FOB Sacto; Send adequate postage:
We refund any overage

JOE PALMER
P. O. BOX 6188 CCC SACRAMENTO, CALIF.

For further information, check number 43 on page 206.

Compare the Incomparable
ROHN Fold-Over TOWERS!

America's finest and most wanted tower for amateur radio use

- Available in hot-dipped galvanizing!
- Fold-Over Towers from 45 ft.— other Rohn models to 300 ft.
- Precision made; fully tested; easily installed.
- Quality-built — gives you the most for your money.

Rohn heavy-duty "fold-over" towers are built especially for supporting amateur beams. These towers can safely lift the equivalent of two full sized, three-element, twenty meter beams stacked plus rotator. Tower is designed to "fold-over" to the ground for antenna installation, changing, or adjusting in seconds. **No climbing necessary.** Get the facts before you buy . . . then you'll know why Rohn is best!

FREE! Write for literature and name of nearest Rohn representative and source of supply. Rohn Products are available coast-to-coast.

ROHN Manufacturing Company
116 Limestone, Bellevue; Peoria, Ill.
"Pioneer designers and manufacturers of all type towers"

For further information, check number 44 on page 206.

New QSL'ing Method

Captain Kurt Carlsen, W2ZXM/M got one of the surprises of his life recently when he was sailing near Puerto Rico. Shortly after a nice QSO with Stan Butryn, KP4AAO, he was alarmed to see a helicopter coming in over his ship and settling down toward the deck. Just before it touched a block of wood painted bright yellow was dropped to the deck and the helicopter zoomed away with a wave from the pilot.

Examination of the block revealed a QSL card from Stan, the pilot of the helicopter.

Beat that one if you can.

New Club Rates Announced

Have the Secretary of your club drop a card to:

Harold Weisner, Circulation
CQ Magazine
67 West 44th Street
New York 36, N. Y.

and ask for the new Secret Appallingly Low Club Subscription Rates. He will try to get these to your club while you are still young. Don't forget to give your club mailing address, eh?

NC-240D [*from page 105*]

catacomb left *inside* the receiver where it belongs.

What about sideband adapters for use with the NC-240D? No reason why the i-f type adapters wouldn't work well. Being of the "rugged school," the author receives his SSB *a la* b-f-o, and has no adapter. The i-f system of the NC-240D is very straightforward, and there is no reason why excellent results would not be obtained with an adapter. You try it and let *me* know! ■

Filter [*from page 81*]

Fig. 5A shows the curve of a filter which can be observed to only slightly better than –24 db down. Now look at *fig. 5B* for the same filter as seen on a screen to read the skirt response better than –45 db down (add –20 db to the figures shown on the db scale).

Attenuator

SW1 with *R25, R26* and *R27,* is an attenuator setup which changes the input level to the vertical amplifier in *20 db* steps to make it possible to obtain readings over at least at *60 db* range, a degree which should be adequate in view of the limited ability of most amateur linear amplifiers, at the present stage of the art, to maintain sideband suppression of

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"TAB" TESTED **Guaranteed**

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0A2	.70	5R4	1.00	6X4	3/1.00	811	2.35
0A3	.85	5U4	.59	7C4	.69	812	3.00
0B2	.65	5V4	.89	10Y	1.00	813	8.00
0C3	.70	5Y3	.59	12A6	.45	814	2.45
0D3	.70	6A7	1.00	12AT7	.70	815	2.00
0Z4	.60	6A8	1.00	12AU7	.64	826	.45
1B3	.78	6AB4	.59	12AX7	.79	828	8.00
1L4	.82	6AC7	.79	12BK7	.75	829B	7.95
1R4	.88	6AG5	.69	12BL7	.79	832A	5.00
1R5	.78	6AG7	..1.50	12BN7	.69	5842	12.00
1S4	.78	6AU6	.59	12BQ7	.69	866A	1.15
1S5	.68	6AJ5	1.00	24G	1.95	954	12/1.00
2C22	20/1.00	6AK6	.69	25L6	.72	955	4/1.00
2C39A	9.95	6AL5	.59	25T	4.00	403B	2.50
2C40	6.70	6AQ5	.66	25Z5	.72	957	4/1.00
2C43	7.45	6AS7	2.95	28D7	.60	958A	.50
2C46	4.95	6AT6	2/1.00	35T	4.00	959	1.00
2C51	2.70	6BA6	.59	50L6	.69	991	5/1.00
2D21	.68	6BA7	1.00	HK54	3.70	1619	4/1.00
2E22	1.85	6BE6	.59	T55	6.95	1625	5/1.00
2E24	2.20	6BG6	1.50	RK20	5.00	1626	10/1.00
2E25	7.00	6BK7	1.00	RK38	4.00	1629	10/1.00
2E26	2.90	6BQ7	1.00	RK47	3.00	1851	1.70
2E30	1.85	6BZ7	1.25	H69	4.00	5654	.75
2V3	2/1.00	6C4	2/1.00	75TL	15.00	5670	1.00
2X2	.45	6C5	.69	100T	6.00	6146	4.00
3A5	.50	6CB6	.80	203A	2.00	6550	4.00
3C24	1.95	6CL6	1.10	211	.49	408A	2.50
3E29	7.95	6H6	.59	233A	1.00	3APIA	6.50
3Q4	.68	6J4	1.72	250T	19.20	3BPI	1.80
3Q5	.86	6J5	.59	254	3/1.00	3DPIA	6.80
3D23	3.95	6J6	.59	388A	1.95	3EPI	1.00
465A	14.95	6K8	1.00	434A	2.00	3KPI	7.00
4125	30.20	6L6	1.00	450T	43.00	5API	2.90
4250	34.95	6SA7	.69	717A	5/$1	5BP7A	25.00
4E27	7.00	6SJ7	.69	801	5/$1	5CPIA	6.45
4PR60	27.20	6SK7	.72	802	2.00	5FP4A	3.00
4X150	18.95	6SL7	.89	805	6.00	5JPIA	14.95
4X250	35.00	6SN7	.65	807	1.05	5JPI	8.70
4X500	43.00	6U8	1.00	808	1.00	5JP7A	18.00
5RPI	1.98	6V6T	.75	809	2.45	5LP7A	23.00
5BP4	1.98	6Y6	.89	810	10.00		

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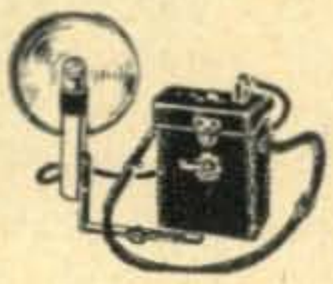
"TABLITE" ELECTRONIC FLASH

AC & Battery Inbuilt One Case



Uses new lo cost lo voltage super circuit constant bright lightoutput; light duration 1/600 sec'd; color K 6800°; cost per flash less than ¾¢, 1000 to 2000 flashes per set of batteries. All with inbuilt AC Pack. (Less batteries.*)

MODEL 400B, 60W sec'd color 75+; B & W 225+. Recycles 2 sec'ds, less than 4 lbs. **$25.00**

MODEL 600B, 120W sec'd color 100+; B&W 300+ **$44.95**

***2—240V Batteries** ..... **@ $11.00**

Photoflash Cond. 525MFD/450V/53W SEC. NEW LOW leakage, Famous mfgr. $13.23 Reg. Price. ..... **$6 @, 2/$11, 5/$25**

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See in Dark Tube

SELECTED, GTD & TESTED for resolution, 1st class image converter viewing tube. Hi-sensitivity simplified design 2" dia. Willemite screen—Hi-Resolution. Tube & Data.

"TAB" SPECIAL ..... **@ $4.75; 2 for $9**

NEW VARIABLE 0 to 6 & 12 VOLT/12 AMP

DC Filtered Power Supply

Battery Eliminator, Charger, Model RR, Plater, Aircraft, Marine or any DC requirement. Extra Hvy. duty Selenium Rectified. 2 meters V & A. Designed for cont. service & up to 20 amps intermittent overload. Input 115 VAC, 60 Cy.

MODEL T6I2V12ACC, 10% Ripple **$33.00**

T6I2V12ACC, only 0.5% Ripple at 5 amps $43.00

NEW TEST EQUIPMENT KITS!

TIK VTVM KIT $24; T5K SCOPE 5" KIT $42
RES/CAP BRIDGE KIT $19; T6K TUBE TESTER KIT $34
THK Hi-Fi 2 Way Speaker KIT $38; 87K SCOPE 7" KIT $76
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WRITE FOR "HI-FI" CATALOG
"TAB" FINEST HI-FI RECORDING TAPE

7" Reel — 1200 Ft. Per Reel
Sold on Money Back Guarantee

$1.45 Lots of 12

Highest quality Hi-Fi Precision Coated & Slit, **ERIN-SHEEN** processed, quality controlled, constant output, **Noise FREE, Splice FREE** Plastic Tape. Freq. 7½ IPS, 40-15KC Oxide-Wnd In. ..... **"TAB" @ $1.59 ea.; 3/$1.50 ea.**

New 1st Quality "MYLAR" 2400 Ft.-7" Reel
Ferro-Erin processed RECORDING TAPE @ $4.49, 3/$12

Registered One Yr. Guaranteed Phono Needles—All Cartridges
Single Diamond $7; Dual Dia $16; Dia-Sapphire $9
Please Send Cartridge Name & Number

SPECIAL CHOKE CH1001 desgnd W.E. 4 Hy. @ 450 ma @ 27 ohms H'Sealed HiV. Insul. Size: 4-9/32x3-7/16x4-13/16 10 lbs. **SPECIAL $3 each, 4 for $10, USN cost $36**

KITS! *Each "TAB" Kit Contains The Finest Selection*

Kit 35 Precision Resistors
Kit 10 Switches
Kit 75 Resistors ½/1/2W
Kit 150 Carbon Resistors
Kit 45 Panel Lamps
Kit 12 Electrolytic Cond's
Kit 15 Volume Controls
Kit 36 Tube Sockets
Kit 65 Tubular Condensers
Kit 500 Lugs & Eyelets
Kit 10 Bathtub Oil Cond's
Kit 5 lbs. Surprise Package
Kit 10 Transmit Mica Cond's

Kit 40 Insulators
Kit 35 Power Resistors
Kit 75 Mica Condensers
Kit 5 Crystal Diodes
Kit 250 ft. Hook Up Wire, Asst'd
Kit 100 Fuses, asst'd all types
Kit 100 Ceramic Condensers
Kit 150 Coil Forms
Kit 5 Crystals & Holders
Kit 65 Inductors & Coils
Kit 5 Microswitches
Kit 10 Wheat Lamps
Kit 3 Transistor Xfmrs

Order Ten Kits - We Ship Eleven!!!

ONE EACH ABOVE KIT ONLY **99c**

ARC/5 274N EQUIPMENT SPECIALS

BC457 As Is	$1.39	BC457/4 to 5.3 Tested	$3.95
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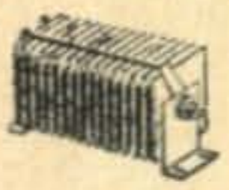

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this order. The attenuator arrangement has been chosen in preference to the use of a logarithmic amplifier (linear in respect to db ratio), because the latter usually requires signal amplitudes within a definite range to maintain its calibration, and so its usefulness over widely varying conditions is limited.

Amplifier-Detector

Next, a means must be provided to convert the rf energy from the filter to a dc potential in order to properly operate the vertical dc amplifier. This is shown as part of *fig. 10A*. A crystal diode is used for rectification in preference to a vacuum tube diode, because the latter generates an initial contact potential which will shift the base line of the oscilloscope every time the gain control is changed, due to the utilization of the dc amplifier; however, a vacuum tube can be used instead of the crystal if the contact potential is nullified by the arrangement shown at *fig. 10B*.

Filters introduce a certain amount of insertion loss in the circuit in which they are installed, so it will be found advantageous to furnish additional amplification ahead of the detector. Isolation between the filter and detector may also be realized with the use of an amplifier. This is also shown in *fig. 10A*. Power is obtained from the Ferri-Sweeper. The coupling between the amplifier and detector is broadly tuned around the filter frequency, so as not to alter the response.

Construction

No special type of layout is necessary in the construction of the Ferri-Sweeper; in fact, this is true of all the units described herein. Almost any convenient arrangement may be used. The Ferri-Sweeper, built by the writer, has the *main tuning* dial at the center of the panel, a small dial at the left for the *bandspread* capacitor, while at the right are the sockets and switch for the calibrating crystals. Along the bottom are the controls for the *sweep amplitude*, the *sweep frequency*, the rf *oscillator feedback*, and the *rf output amplitude*. Auto radio coax type of fittings are used for the output terminals. A 7" x 11" x 3" chassis is used with a 7¾" x 11½" panel. The entire unit is mounted in a metal cabinet taken from a *TU type* Surplus tuning unit.

The rf oscillator coil, *L1*, is wound on a special toroid core which may be obtained from United Products, 165 Franklin Ave., Nutley, N. J. The price is $1.00, and the item is listed as Crowley core, type *CR70*, part #*5391* for Ferri-Sweeper. One layer of black electrical scotch tape is wrapped around the core, after which the wire is wound on it. The wound core is mounted with one end of a wooden dowel inserted through the core hole and cemented in place, with the other end of the dowel screwed to the chassis.

Although no special arrangement is neces-

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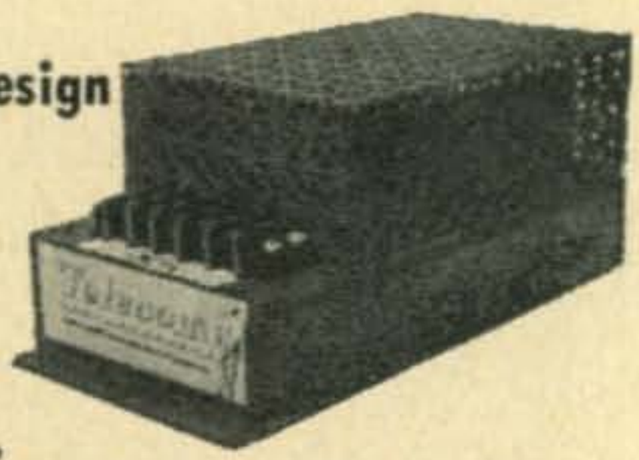

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sary, a suggested layout for the dc amplifiers, which will permit easy wiring, is shown at *fig. 11*. The amplifiers, used by the author, are built into a complete oscilloscope using a 2″ CRT, with rear terminals for connections to an existing 5″ oscilloscope, so a complete oscilloscope is available, featuring compactness and portability for use in other applications.

One precaution which should be taken is to shield the input and grid leads of the first amplifier stage, and to keep the input potentiometer away from leads which carry ac power. It will also be found best to wire the heaters with both sides above ground, twisting the leads together between socket-runs. Then ground either the heater center-tap at the power transformer, or ground one leg of the heaters at one point, preferably at one of the 12AX7 sockets. This will prevent 60 cycle hum pickup from ac currents flowing through the chassis. Tube shields are not required.

Power supply requirements of 6.3 v. @ 1.8 a., and 250-300 v. @ 15 ma. are easily handled by the built-in supply; however, if the equipment is to be used at locations where large power line variations are apt to occur, it will be found beneficial to employ voltage regulation for both the plate and heater power sources. Dc amplifiers are very sensitive to power potential variations, so occasional positioning shifts can be experienced. This is a small price which must be paid for the benefits derived from the use of dc amplifiers.

Plate supply regulation may be obtained from VR tubes or other electronic arrangements. Heater supply regulation may be derived from the use of a good grade 5 volt transformer with 6 to 8 ufd of capacitance connected in series with one leg of the primary winding.

The amplifier-detector should be built as a separate unit with any convenient layout. Input and output leads should be isolated or shielded. Wire both heater legs above ground with power connections made to the Ferri-Sweeper as shown in the diagram.

The variable input attenuator may be mounted in a small separate box, on the vertical dc amplifier chassis, or with the amplifier-detector. The resistors should be mounted directly on the switch terminals, and the input and output circuits should be isolated from one another. The exact given values for the resistors need not be used as long as $9 \times R27 = R26$, and $9 \times (R26 + R27) = R25$.

Unfortunately, due to the limitations of space, we are unable to print the full adjustment and operating instructions for this filter alignment unit. These are available, however, to those of you that are going to build this equipment. Merely drop a stamped envelope to CQ Magazine, 300 West 43rd Street, New York 36, N.Y., and it will be mailed to you. ■

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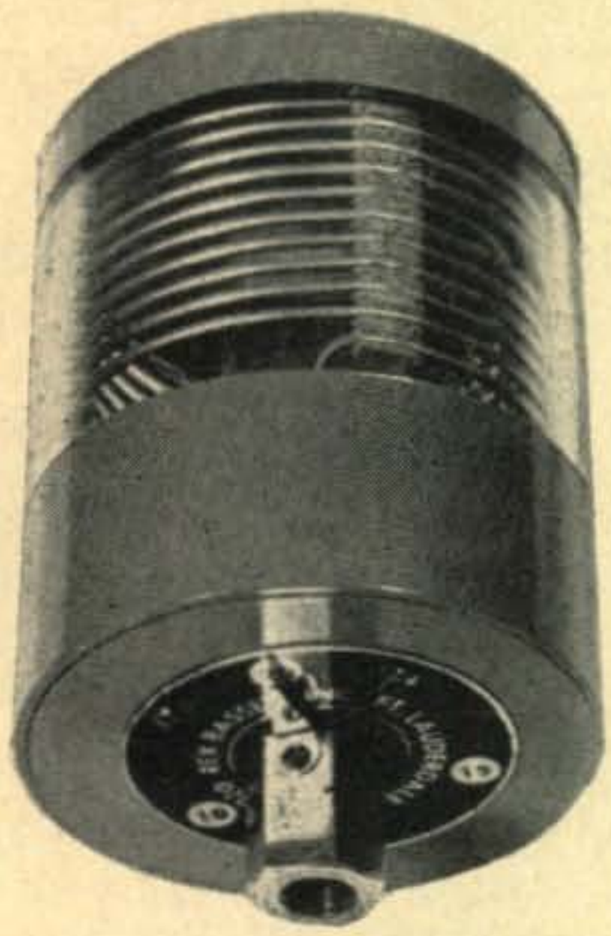

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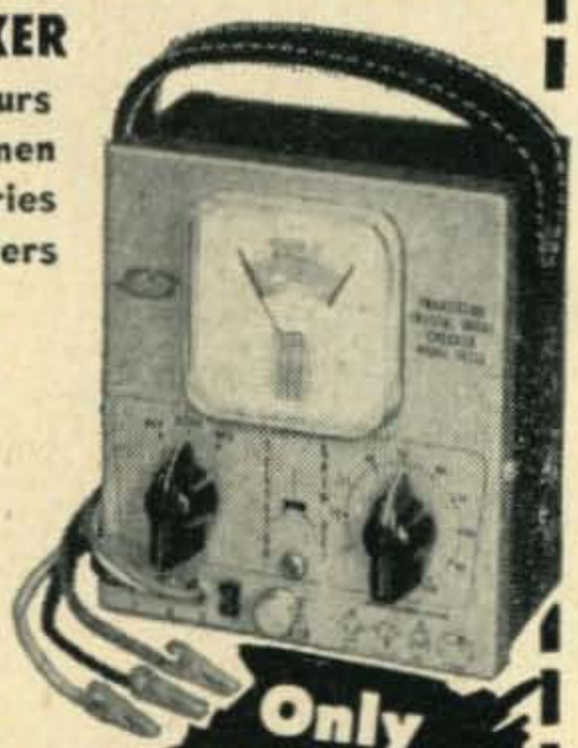

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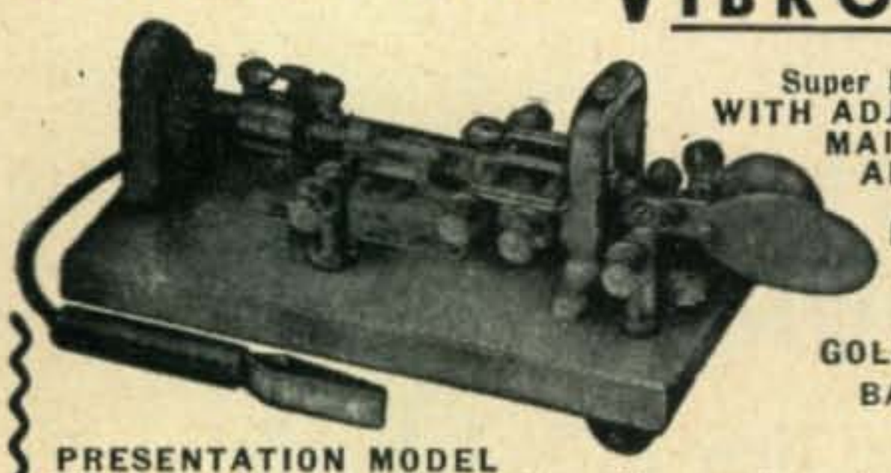

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Garbage Disposal [*from page 83*]

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Remember, keep the i.f. high, the local oscillator above the band, *and* insert a GDU in the line for pleasant interference free listening.

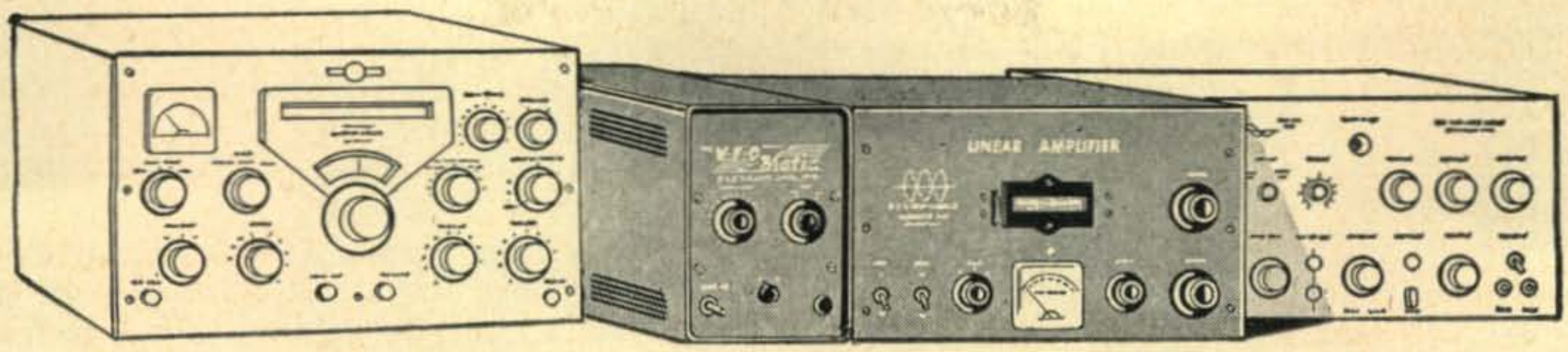
See you on 220. ■

RTTY [*from page 39*]

disappointments. The wife came home and said I looked peaked. I did not eat much supper and she wondered whether I was sick. I was, but I could not tell her why; after all she might laugh at me and that would be far worse than her calling me all kinds of a fool. Before retiring I carted the whole sad business down to the cellar. Out of sight, out of mind, I hoped. In the middle of the night I woke up as out of a bad dream. Now I recalled vividly, of course, that is what he told me, "Don't buy a Model 122, and be sure you get a synchronous ac motor in your machine." That blasted tank in the cellar must be what is called a Model 122. But how was I to know? I had only seen one machine before, and the one I saw was not like this one. Then the forgetfulness of sleep.

I was sorely tempted to write "the nearest *active* RTTYer" and tell him what happened, but after all, this would just make me look ridiculous and there was nothing he could do for me.

Now . . . transmitter tracks automatically with receiver



Plug new V-F-O-Matic into Collins receiver . . . automatically keeps Xmtr zeroed to receiver frequency

NEW V-F-O-MATIC . . . plugs into 75A-2, -3, -4 Collins receivers; requires no rewiring or changes; does not affect calibration, sensitivity or adjustments. Collins precision VFO furnishes freq. control for both send and receive. For all SSB phasing type exciters (10A, 10B, 20A, Phasemaster, Hallicrafter HT-32, etc.) using 9mc mixer frequencies. Automatically zeros in Xmtr to exact freq. received. Operates both upper and lower SB on 75 and 20 meters. Complete with power supply. (Model 80-10 all-band unit for KWS-1 also available.) Immediate delivery.

PRICE $124.50
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LA-400-B LINEAR AMPLIFIER . . . simplified multiband operation on 75 thru 10 meters. Improved TVI suppression. New metering circuit reads RF voltage input, plate current and RF amps output. Low Z, untuned, 400-watt P.E.P. input with more stability, better linearity, only 20 watts drive. Pi-net output. Designed around four Modified 1625 Tetrodes. Especially effective for SSB; also delivers high quality signal on AM, PM, CW. Ideal for portable use. Complete with power supply and tubes. Teams well with V-F-O-Matic.

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ALSO AVAILABLE
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For further information, check number 52 on page 206.

THE C & G 7-BAND ANTENNA SYSTEM
IS PROVING ITSELF!

CAN CHANGE BANDS QUICKLY !
Roy Devish, W7AZI, says; 'I didn't know how much fun being a ham really is until I got my model 200. I can change bands quickly with no tower climbing or elaborate switching.'

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Phone
BR 3181

For further information, check number 53 on page 206.

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Primary 110 V.-60 cy. 1½ KW. Secondary 2350-0-2350 V AC @ 680 mils full wave by using two transformers. Each —Size: 7"x7"x7". Weight 40 lbs. each with Porcelain Insulators..... 2 FOR **$24.94**

1 of above 2350 V. AC @ 340 MA ½ wave. Each $14.94

OIL CONDENSER SPECIALS—BRAND NEW

10 MFD	500	VAC	3.49	8 MFD	1500	VDC	2.94
2 MFD	600	VDC	.49	24 MFD	1500	VDC	6.94
4 MFD	600	VDC	.74	1 MFD	2000	VDC	.84
6 MFD	600	VDC	.84	2 MFD	2000	VDC	1.49
8 MFD	600	VDC	.94	4 MFD	2000	VDC	3.49
10 MFD	600	VDC	1.18	2 MFD	2500	VDC	2.49
12 MFD	600	VDC	1.49	1 MFD	3000	VDC	1.84
1 MFD	1000	VDC	.59	4 MFD	3000	VDC	6.94
2 MFD	1000	VDC	.84	1 MFD	7500	VDC	6.94
4 MFD	1000	VDC	1.34	.5 MFD	7500	VDC	2.94
8 MFD	1000	VDC	2.44	2 MFD	10,000	VDC	39.94
10 MFD	1000	VDC	2.94	1 MFD	15,000	VDC	39.49
1 MFD	1200	VDC	.44	1 MFD	25,000	VDC	59.49
1 MFD	1500	VDC	.74	8 MFD	660AC (2000 DC)		2.34
2 MFD	1500	VDC	1.09				
6 MFD	1500	VDC	1.94	16 MFD	660 AC		2.94

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10 HENRY 80 Mil (unshielded)	89c
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8 HENRY @ 200 Ma	1.94
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0-1 Mil (Dual scale 0-500V, 0-1000 Ma)	3.48
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0-200 Ma DC	2.94
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0-200 Mil DC	3.94
0-1 Amp DC	3.94
0-15 Amp DC	3.94
0-25 Amp DC	3.94
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0-7.5 V. AC	3.94
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110V. 60 cyc. .3 Amp. 1600 Rpm. 3¾" Blower wheel—Outlet 2" Diameter. Suitable for cooling Transm. tubes, etc. .....2 for $14.99 ea. **$7.94**

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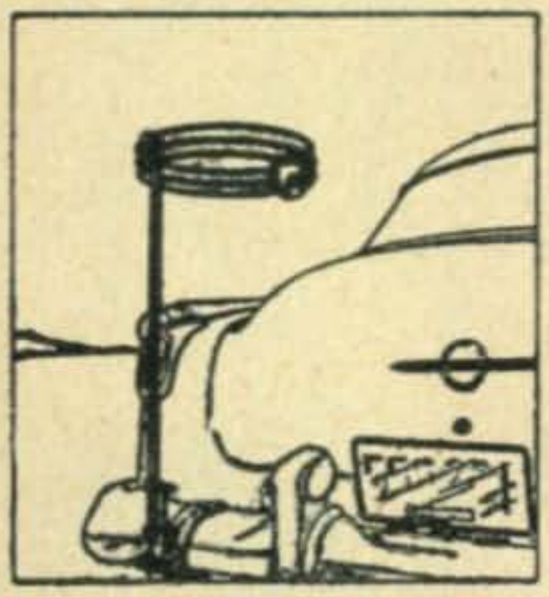
For further information, check number 54 on page 206.



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Horizontal polarized 6 meter MOBILE antenna.

Reduces flutter . . . swish . . . ignition noise . . . a full sized antenna available with clamp-on bumper mount. Also supplied less mounting accessories. *AVAILABLE NOW.*

Write

HI-PAR PRODUCTS CO.
Fitchburg, Mass.

It was decided that the next best thing was to ask for advice and just forget all about the first misstep. In due time a reply was received, and the question of what page printer to purchase was settled. A name and address followed shortly. Printers were available, a check dispatched, printer received with a table and part one of the drama concluded with the motto, "one for the price of two."

The new page printer stands silently in the shack and looks very ready. Every once in a while I get a query from the XYL as to why I need two printers and what is the matter with the one in the cellar. So far I have been successful in avoiding answering this question very clearly but one of these days I feel I will run out of excuses. However, my pride is safe for the time being.

The next step was the Terminal Unit which would bring the printer to life. This would give me something to show for my investment. At this point the bulletin I received during my period of indoctrination came in. This parting gift had been lying in my desk all this time since I had forgotten about it, but now it was to become very useful. It said on page three, along with a diagram that polar relays were absolutely essential, and it also told where to get them and how much they cost. Before realizing what had happened, I sent for two polar relays. Of course I forgot to order jack bases so that took another letter plus a check. Now, the polar relays will not operate a printer by themselves so something else must be done. In looking through the Bulletin once more I found a store dealing in surplus converters. Might as well try one of those until I get around to building my own converter. The alphabetical designations of these units was fascinating but absolutely meaningless. I saw FSK and AFSK units. I wondered which might be best? Let us try the FSK. How was I to know that they worked on the receiver IF and that they would not function on 85 kc. The XYL asked: "Why are you taking this to the basement, I thought you needed this in the radio room?" My reply: "Well, there are some adjustments to be made before it will work, so, in the meantime, until I can get to it, I shall keep it out of the way."

The next unit on the list was the AFSK job, but here I was real cool and poised. A few dollars spent on a long distance call convinced me that I had better leave that one alone unless I wished to rent a moving van and some strong backs to go along with it. In fact, I don't think I could ever move it to the basement should the need arise. I may not be printing yet, but I am piling up equipment. Due to the converter fiasco the page printer still stands silently and accusingly in the corner of the shack. The only thing to do is to build a converter and then at least I shall have the assurance of knowing it will work. Having previously ordered all available back issues of all conceivable magazines

MM·1 + Receiver Monitoring = MM·2

All the transmit features of the MM-1 *plus* RECEIVER MONITORING are presented in the new MULTIPHASE RF ANALYZER MM-2.
For use on SSB, DSB, AM, PM and CW.
RECEIVER MONITORING – use with any receiver. Look at received signals. Give reports of Overmodulation, Flat-topping, Parasitics Key waveshape, etc. Simple connections, no holes to drill, plug-in IF unit. New features asked for in your letters.

New variable sweep control with improved speech locking for transmit and receive.
TRANSMITTER MONITORING – NO TUNING, BROADBAND response flat from 1 MC to 55 MC at power levels of 5 watts to 5 KW. Useful indications to 200 MC. For use in "series" with 52–72 ohm coaxial lines. A short pickup antenna is recommended for other systems. RF attenuator controls height of pattern in 3 db steps. Function selector for envelope, trapezoid or bow tie patterns. Built-in 1 KC oscillator.
Silent, Automatic, Electronic switching between RECV and XMIT triggered by transmit RF.
Model MM–2 wired, less IF Adapter . . . . . $129.50 Kit . . . $99.50
Plug-in IF Adaptors – Model RM–50 for 50 KC IF, Model RM–80 for 80 KC IF, Model RM–455 for 450 to 500 KC IF $9.95
Watch for early announcement of our new Model 100V Broadband Exciter-Transmitter with built-in Linear VFO. It will be advertised when it is in stock at your distributor.

WRITE FOR INFORMATION

MULTIPHASE EQUIPMENT

Central Electronics, Inc.
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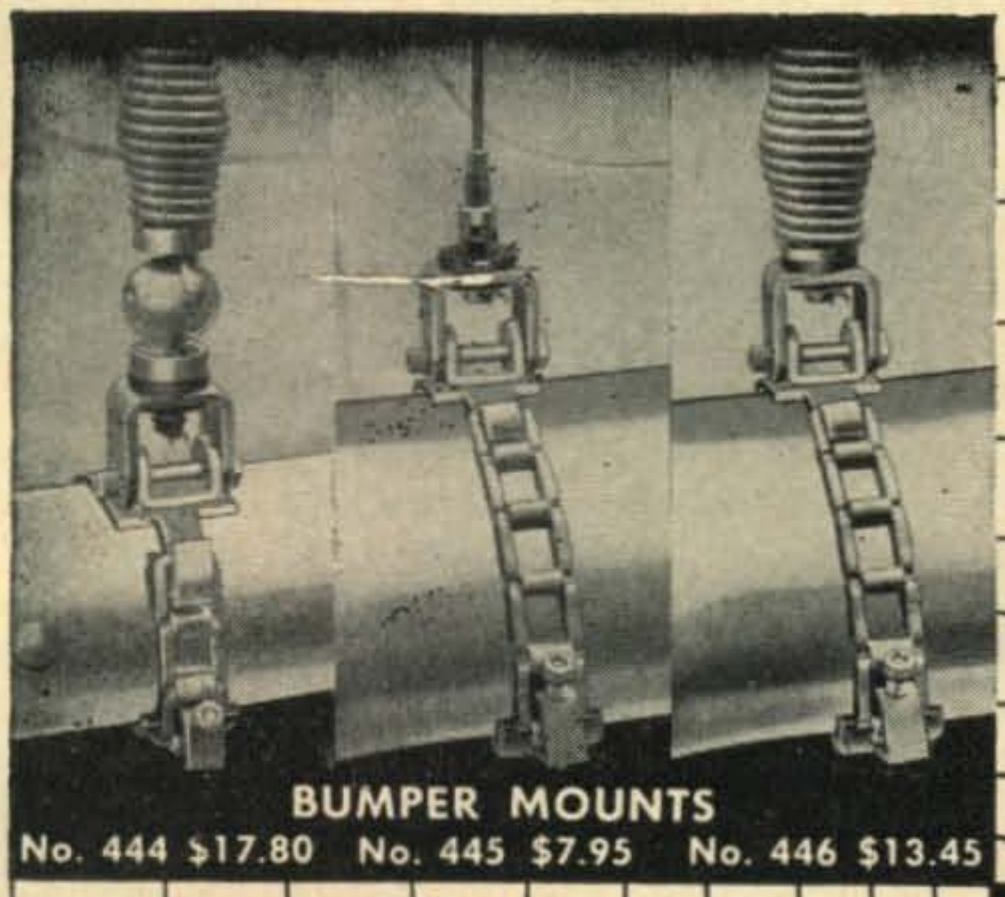
For further information, check number 55 on page 206.



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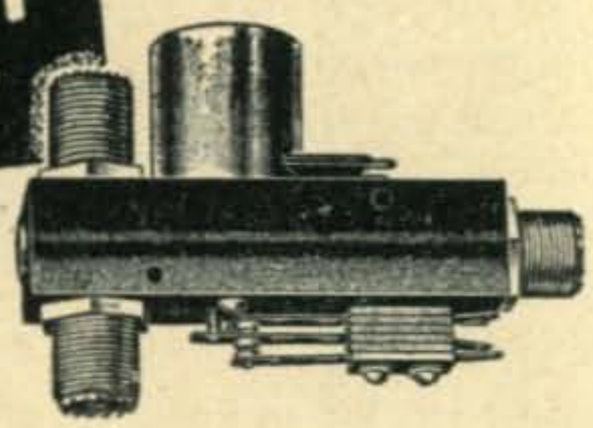
SILENT Coaxial Relay



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TESTED AND PROVEN BY AMATEURS AND INDUSTRIALS

New magnet principle makes high-contact pressures possible —gives a new concept of low-contact resistance. Free of AC hum or chatter, available with special receiver protecting connector and heavy-duty external SPDT switch.

One-million operations completed in life test with no apparent deterioration. Power consumption, AC models approx. four watts; DC models three watts. V.S.W.R. at 150 mc 1.1 and 1.2 at 300 mc. Coil voltages: AC 6, 12, 24, 110 and 220; DC 6, 12, 24, 48, 110 and 220. Special coil voltages available. GUARANTEED! Fully backed by factory warranty for unit replacement.

DOUBLE MALE-CONNECTOR (DKF2) for mounting relay directly onto output of transmitter. See your local electronic parts dealer or write direct for complete specifications.

Price $10.90 to $15.65

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WARREN, MINNESOTA

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TELEGRAPH set **TG5** w/key & case **$5.95, Thigh** code key **J45 $1.98, J38** w/on-off switch **SPECIAL $1.49.**
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TRANSCEIVER BC645 w/17 Tubes converts to 420-500MCS **NEW—@ a GIVE-AWAY PRICE $21.95, BC-620** 21-25.5 MC uses but does not incl. PE120-less Extal **$14.95, BC-659** Extal control 27-38 MCS uses but **does** not incl. PE120 **$14.95 BC-375** 100 Watt 200-500 KCS, 1500 to 12,000 KC **$29.95 BC-625** 100-156 MC **$22.45.**
RECEIVERS—BC-683 FM Superhet **27-38** MC, 12v input with **Tubes $38.95.** FM rec. w/10 preset channels 19.68-27.6 MC 24v input **$29.95, R9A/APN4 LORAN REC. NEW $19.95.**
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METERS—IS-182 2" Dia 0-6Amp RF **$4.49.** O-3Amp RF 2"D. **$4.50.**
CHOKES—8 hy/235ma **$1.95, Dual** 9hy/125ma-10hy/100ma hvins **99¢ Swing** choke 15-29 hy/200ma **$1.95.**
CAPACITORS—var 20-135 MMF hvins **65¢,** 8-26MMF hvins **35¢,** 15-77MMF hvins **65¢,** 19-116MMF hvins **75¢,** 14-66MMF hvins **65¢,** 15-81MMF hvins **55¢,** 15-77MMF hvins **45¢,** 14-62MMF hvins **35¢.**
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VARIABLE CAPACITOR—dual 15-25, 277-283 MMF **99¢.**
BC-610 Coil-1 to 1.5 & 2-3.5 MC **$2.98. BC-605** interphone amplifier with Tubes **$4.95.**
All shpts. FOB whs. Send 25% dep. with all C.O.D. orders. Item sub. to prior sale & change of price without notice. Min. order $2.50.

EAST MEADOW SURPLUS CO.

462 Chestnut Lane, Dept. Q11, East Meadow, N. Y.

For further information, check number 58 on page 206.

and bulletins dealing with RTTY the problem reduced itself to the selection of a particular converter or terminal unit desired. I felt that this was far too easy a solution to be true and after leafing through about thirty publications I came up with some even dozen terminal unit diagrams, each one claiming to outperform any other terminal unit ever described before or after. Rather than go into a state of shock over this situation I decided to handle this matter in another way. Sheer logic will show that all terminal units have certain parts in common, and it therefore follows that the acquisition of these common parts is a step in the right direction. Not the least among these common parts are the filters. Toroids were decided upon because of a haunting mental picture of a fellow on his hands and knees picking up laminations from the floor of his workshop after having disassembled an FL8-A filter unit. Incredibly enough, a collection of toroids was found in a small shop on radio row and the entire lot bought for a song. There is no need to describe the building of the filters. This was not difficult since all it required was the preliminary building of an audio oscillator and calibrating same, the purchase of an oscilloscope kit and assembling same and the purchase of approximately one gross of high quality paper condensers of all values. Two months later, presto, toroid filters.

Right at this crucial point something happened which cannot be explained. The urge to get tape equipment became like an obsession. Everything else was forgotten. The filters lay unused on the work bench surrounded by a multitude of other converter parts. The soldering iron remained cold. At the supper table the subject of "tape" was broached cautiously to see if any observable reaction might indicate which way the wind was blowing, but I might just as well have been speaking about the price of iguana skins in Jamaica. This was all I needed. Like one possessed I leafed through the publications until I found an offering of a tape distributor, a tape transmitter and somewhere in another list, a tape perforator that only required a little adjustment to make it perfectly usable for the amateur. If you have a machine shop at your disposal you can alter it to do anything you want. By now feel I can do most anything with any kind of tape you can dream up. I can punch five, six and seven holes in almost any size tape except the right size. Of course, I cannot run the punched tape through my transmitter, but that is a minor matter. My distributor runs with an AC governed motor and it is never quite right. That too matters but little since it does not have the right number of segments to distribute anything I can punch. Even the sensing pins on the transmitter are an odd number.

My basement is rapidly filling up. At present the topic of RTTY is hardly ever brought up

at the supper table, and talk about tape is strictly taboo.

Some day I shall finish my terminal unit and start building an FSK oscillator, that is, if I can get the bank to keep carrying my loan. Surely there must be in existence many fascinating circuits for transmitting RTTY. Let's look in the bulletins. Hm . . . Press Wireless, TMC, Northern, Army and Navy Surplus. On second thought, perhaps I had better get some advice first. ■

Noise [*from page 48*]

By the simple expedient of lifting the control grid of the final above ground while on stand by, (*Fig. 1*) the noise was eliminated and Marv is again happy with his TR switch. He did not find the addition of bias to be necessary.

He experimented with various tubes in his grounded grid final. These include the 4-400A; 4-125A; 4-65A; 803 and 837. In each instance the solution proved effective. Static plate current on the 4-400A was 100 ma. at a plate voltage of 3,000 volts. When the grid was lifted above ground, the static current dropped to 85 ma.

Since the lead carries only d.c. its length is not important. Most commercial SSB exciters such as the 10A, 10B and 20A have spare relay contacts in the voice control circuit. These will do the job very nicely. If spare contacts are not available an additional relay actuated simultaneously with the voice control relay will suffice. ■

KW [*from page 109*]

rating. Also, due to the comparatively low voltage, tank circuit losses are less. Because of the care used in design and alignment of the various elements within, the output holds up in a linear fashion at the minimum-voltage limits of the plate-voltage swing. This advantage becomes marked especially when SSB operation is contemplated, as the distortion arising from nonlinearity in this section of an amplifier can be great. To offset such distortion usually requires operation at lower efficiencies as well as the use of rf feedback networks found only in carefully designed equipments at present.

The result of all this is a very cool (in every sense of the word) operating amplifier of ample proportions. Gone are the nights where "it is possible to read by the light of the plate" dissipation. In fact, it is difficult to detect by simple observation of the tube whether the "filament is going" or not, so complete is the internal shielding. An output indicator, still a superior device to determine whether you have maximum rf going up the feeder, is the order of the day. "Turning up the wick" on this rig can result in a solid signal! ■

Receive "Ham" signals anywhere, on any set with Model ATC-1 Transistorized Amateur Band Converter by

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WORLD'S ONLY SPECIALIST IN TRANSISTORIZED EQUIPMENT

ARE YOU MOBILE?

Model ATC-1 is *Self-Powered* (3 penlight batteries, shelf life expectancy); simple to connect—*one connection to antenna, other to receiver antenna input; only 4¾" x 3¼" x 4 1/16" — 30 ounces* — small and light enough to be carried easily, mounted in any convenient spot in car; adaptable to any receiver—*receives AM, CW and SSB on the 80, 40, 20, 15 and 10 meter amateur bands;* a natural for *new cars using 12 volt tube and/or transistor receivers;* the answer to *mobile SSB listening*—built in BFO plus a high degree of stability make the tuning of SSB, DSB, or CW signals a pleasure; provided with *outstanding selectivity on AM phone* by the modified "Q" multiplier circuit. **Model ATC-1, $79.50**

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For further information, check number 59 on page 206

BENDIX TA 12 TRANSMITTER

100 Watt. Can easily be converted to 80, 40, 20 and 10 meters. 4 separate output tanks, one 4 position selector channel switch. Has seven sections which change the ECO, IPA, and output tank simultaneously, complete with tubes. New **$23.95**

MP28 power supply for above $14.95

ANTENNA—Monel Metal

TRAN. REC.—Telescopic Extended 8 foot collapsed —17½" x ½" Dia. Brand New **$1.69**

BC-659 FM Receiver-transmitter, xtal controlled, two channels, freq. range 27-38.9 Mc, 13 tubes, built-in speaker, dual meter for testing filament and plate circuits. Exc. **$14.95**

BC 620

Same as above except less spkr. and 20 to 27 Mc. **$6.95**

BC 603 Ten Channel Push-button or continuous tuning FM RECEIVER 20 to 28 Mc complete w/tubes, speaker, squelch circuit, 12 volt power supply. Exc. **$14.95**

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BC 604—10 Channel, 30 Watt Crystal Controlled 20 to 27 Mc Transmitter. Complete with tubes and 24 Volt Dynamotor. Ship. wt. 30 lbs. Exc. **$14.95**

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ATR—11 TRANSCEIVER 2.5 Mc to 6.7 Mc complete w/12 tubes. Exc. **$29.50**

12 Volt Dynamotor for above $14.95

Both units for 39.50

AMPLIFIER, complete with 2-6V6, 6SL7, 6SN7, 6X5. Ship. Wt. 10 lbs. Exc. **$2.95**

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Heterodyne, crystal calibrated, modulated with calibration book 125KC to 20,000KC—Exc. ..... ea. **$49.50**

less calibration book—$29.50

T-20, 4 to 5.3 MC—T-21, 5.3 to 7 MC. Used ..... $3.95 NEW **$5.95**

3 to 4 mc. like new $5.95

T-23 100-156 MC ..... New $13.95

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Bendix 100 Watt Transmitter

Easily converted to 10-20-40-80 Meters. Has four separate output tanks. One 4 position selector which changes the ECO IPA and output tank simultaneously. Uses 2—807 4-12Sk7. Complete w/tubes ..... ea. **$22.95**

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PL-68 on 3 ft. cord ..... ea. $ .49

PL-55 on 3 ft. cord ..... ea. .29

RM29 New 3.95

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R W ELECTRONICS

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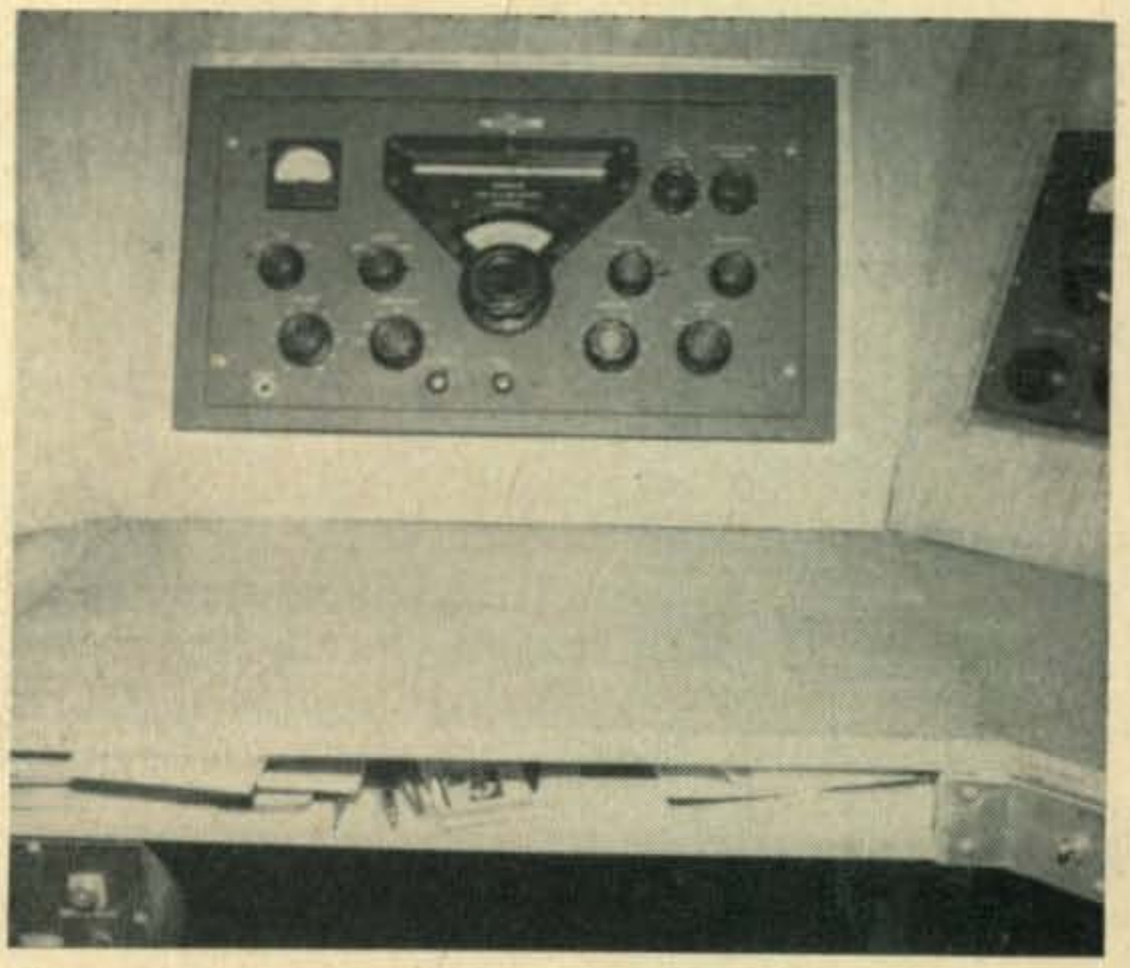
For further information, check number 60 on page 206

Console [from page 129]

ment used. The only wiring shown is an aluminum gutter for 5 coax leads to various antennas, terminating in a *B&W* 5-position coax switch. Switches on the right of the operating position are for a beam rotor and for switching the antenna relay from one final to another.

The openings for the equipment were cut ½" oversize, giving ¼" clearance for easy removal of the equipment. After looking for suitable trim for these openings, we used 24 gauge aluminum strips, 1" wide, bent 90° at the local metal shop. These pieces were cut to fit with snips, small holes drilled, with matching holes into the wood. Chrome-plated nails were used to fasten.



Close-up showing space for logs, etc. under the main operating position.

Too much emphasis cannot be placed on careful use of the level. Starting at either end, carry this same elevation completely around the console. Use the level to plumb vertical pieces as well. I found that supposedly plumb house walls were no such thing, and that the concrete floor was not level, nor was it square with the wall. Now, if we should ever get the garage straightened up, I'll have to build the console again. ■

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ONE BALUN FOR 1.5 to 30 mc

Full Kilowatt Rating When SWR is 2 to 1 or Better

BALUNS Now in Full Production:

	Price
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NEW—Transformer that matches between 50 ohms coax and 75 ohm coax. Same ratings and case as the baluns. T-1 R.F. power transf. 17.50

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Specifications: 6" wide, 13" long, 4" deep. Weight 10 lbs. Otherwise same ratings as above.

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AN ELECTRONIC T-R SWITCH THAT REALLY WORKS!

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Don't confuse this great, new electronic Transmitter Receiver Switch with anything similar you've ever known! Here is a truly effective, efficient and practical replacement for that time-worn coax relay. The Lynmar TRS-1 Switch is designed for any amateur transmitter, home-made or commercial. Wonderfully tiny, it hides away inside most transmitters (1½ x 1½ x 2¼, weighs approx. 4-oz.), does not add any TVI and makes most receivers perform better. Under test, receiver sensitivity increased up to 15db when used with transmitters of 150-watts or less . . uses negligible power for operation and takes 6.3 volts filament and 150 volts @ 13 mils for plate of type 6AH6 tube, ordinarily supplied by transmitter. This switch is a must for every Ham rig!

PRICE $11.95 (with tube)

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Consultants and Manufacturers

ELECTRICAL - MECHANICAL ELECTRONIC

For further information, check number 61 on page 206

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XC-144

Two Meter grounded grid 417A Crystal Controlled Converter. 2.8 db Noise figure, 33 db Power gain, 60 db Image rejection, 80 db I.F. rejection and 80 db down on all other spurious responses. XC-144 output 14 to 18 mc. Other models — XC-144-C output 26 to 30 mc, and XC-144-N output 30 to 34 mc. Price $84.95

Special DOUBLE CRYSTAL Converters Available for COLLINS 75A4 receiver
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Ask your dealer or write to **TAPETONE, INC.**

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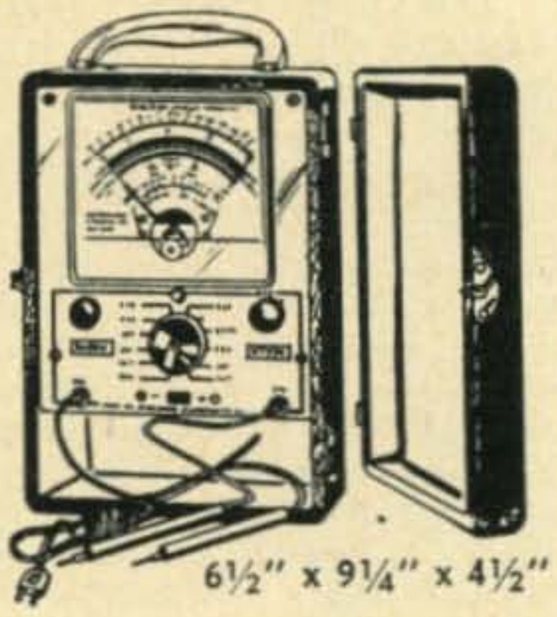

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OUTPERFORMS ALL SERVICES OF A VOLTMETER

PLUS

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- **SINGLE CONTROL** selects range and function instantly.
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- **SURPRISINGLY LOW PRICE** for factory wired and tested instrument—includes factory warranty, instructions, test leads, isolation probe.

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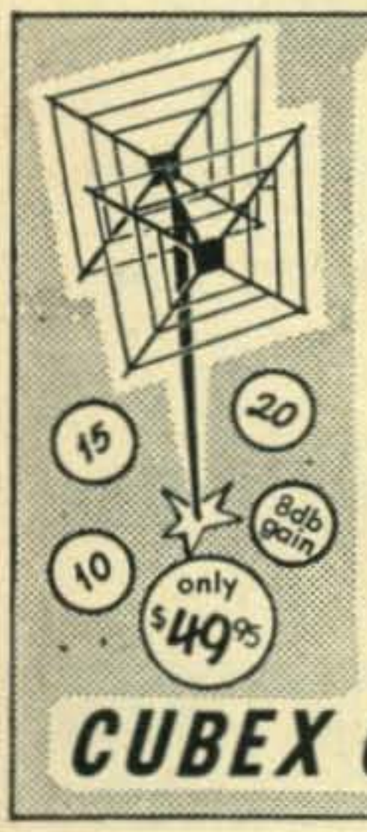

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Cubex QUAD

- EQUALS 3 EL w.s. BEAM
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- ONLY 16.8' wide - NO STUBS

Dual-band 15-20 $44.95
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factory prices —— f.o.b. arcadia, cal.

— write for brochure 'd' —

CUBEX CO. 3322 TONIA AVENUE ALTADENA, CALIFORNIA

Why Pi? [from page 127]

for Radio Engineers," 3rd Ed. p. 120.)

$$\frac{E}{E_o} = \left[\frac{1}{\sqrt{1 + \left(2Q \, \frac{f - f_o}{f_o} \right)^2}} \right]^2$$

and

$$db = 20 \log_{10} \frac{E_o}{E}$$

Here we choose a circuit Q of 15 (same as for the Pi-Network) and the same rig with 300 watts output on 4.0 mc.

2nd Harmonic: –59db, or approximately 50 *micro*watts output on 8.0 mc.

3rd Harmonic: –71db, or approximately 2.5 microwatts output on 12.0 mc.

4th Harmonic: –98db, or approximately 0.031 microwatts output on 16.0 mc.

Sure seems good—on paper! Truthfully now, if carefully built, computed and designed, the results of the Modified Z network will both please and amaze you.

Tuning and Adjusting the Modified Z Network

Assuming that you have the 3 coils and their associated components hooked up and in place in your rig, proceed with the tuning as follows:

1. Disconnect your antenna from the network and resonate the plate tank leaving capacitor C1 about one-third meshed.

2. Tap your antenna onto the antenna inductance.

3. Alternately load the rig with capacitor C1 while resonating it with capacitor C until the predetermined final load is achieved. If you cannot find any point at which the load meets your requirements, tap T4 down on the antenna inductance one *turn at a time* until you find the resonance-load point. Do not be alarmed if tap T4 passes tap T3 on the way, it just means that your antenna impedance is *less* than the link. After the correct tap T4 position has been found, and except that it be lower than tap T3, cut off the excess unused turns except for 3. That is, leave 3 unused turns at the top of the antenna inductance as insurance against weather changes, or voluntary changes by you in your antenna. *Never short turns on the antenna coil!* Such shorted turns introduce enormous losses!

That's about all there is to it! No sweat, no strain, no pain. And a minimum of losses, less harmonics and better antenna efficiency.

Like we said at the very beginning, "Why Pi?" ■

GLASS EYE [*from page 68*]

However, in the case of the 6AL7, less conduction causes the pattern to get dimmer. A negative 7 volts will cause the pattern to completely disappear. That characteristic was used as modulation indicator. A small amount of the modulating voltage was "swiped" from the secondary of the modulation transformer. The magnitude of this voltage was controlled by a pot and then rectified by a crystal diode. The negative voltage varies in direct proportion with the amount of modulation, the louder you speak, the more negative voltage that is developed. This voltage, when applied to the grid of the 6AL7, causes the intensity of the pattern to vary. The pot should be adjusted while using a scope so that 100% modulation causes the pattern to just disappear. Admittedly, this is a very rough indication of modulation percentage, but it is better than nothing!

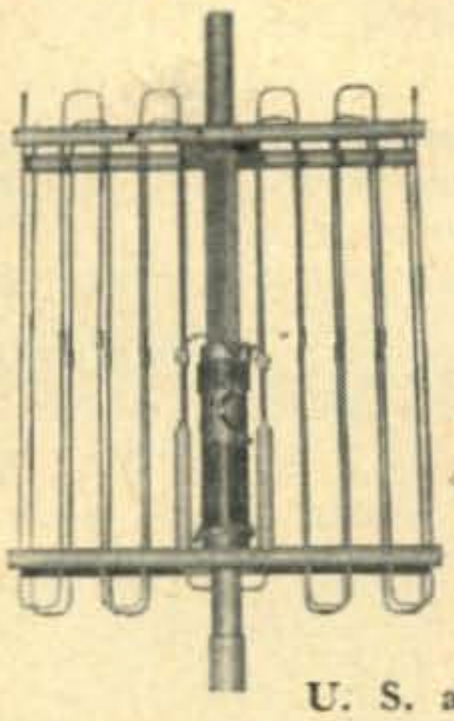
Using The Glass Eye With the 28-9er

Do not get the idea that The Glass Eye can only be applied to VHF rigs. *Fig. 6* is the adaption to Roy Smith's fine 10 meter rig, the 28-9er. The unlabeled parts are the same as those shown in *The CQ Mobile Handbook*. The connections are quite similar to those in the 522 circuit. The electrodes for the tops of the bars meter the driver stages and the control grid indicates modulation. However, since we have fewer stages than in the 522, the electrode that controls the bottom of the two bars was utilized to measure the output voltage across the transmission line. It does not indicate how much power you are putting out because the voltage across the transmission line is a function of impedance. It is used as an indication of when you are putting out the maximum amount of power. The 2-10 mmfd padder is the calibration adjustment for the output. When you have tuned the final amplifier for maximum output (as indicated by a field strength meter) adjust this capacitor until the bars are about in the center of their travel. Now, when using the rig, it is a simple matter to adjust the tuning and loading capacitors for maximum output as indicated by maximum displacement of the bars.

Undoubtedly you can think of many more applications for the 6AL7. One other use might be an intermittent checker for the serviceman. Three of four probes attached to the suspected circuits would soon show up the defect by the flickering of the bars or by the intensity of the green glow.

Someone ought to figure out a way to use the 6AL7 in an all channel, transistorized, high fidelity, color television set. The pictures would be small, and have predominant green tint, but there should be a market for it. Think I'll get to work on it. ■

so small...so light...but so



MIGHTY

Only 27" HIGH

U. S. and foreign patents pending

THE Little GIANT BEAM ANTENNA

The high order of efficiency in this new "Byquist" principle permits input in excess of the manufacturer's specifications. This is a normal function of the antenna and will permit loading of the final 125% to 150% of the rated input to the final. Fully resonant at a HALF WAVE within the specified frequencies. Antenna minimizes harmonics and has bi-directional characteristics. Equipped with standard 52 ohm co-ax fitting in base. Stacks 1/1 or 2/2 with standard co-ax fittings and cable.

Less Weight per Megacycle, Only 18 lbs.

F100	F100L
(7MC-14MC) Handles up to 1 KW. Standard Model.	Frequency coverage: 75/80/CAP. Standard Model. Power input up to 500 watts.
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F100-P	F100L-P
(7MC-14MC) Handles up to 1 KW. Silver plated for peak efficiency and weather resistance.	Frequency coverage: 75/80/CAP. Power input up to 500 watts. Silver plated for peak efficiency and weather resistance.
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Manufactured under the direct supervision of the inventor, Stan Byquist.

SYNCRO MODELS coming soon for full band resonance from your operating table.

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For further information, check number 64 on page 206.

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Non-inductive, non-conducting, non-absorbing Glas-Line isolates systems from directional arrays, rhombics, etc.

The new main insulator of W3UCT. The Glas-Line is between the two egg insulators running to the lower left. The copper link between the center egg insulator and the upper right egg insulator is for the dead-end feeder of a Zepp antenna.

View of an open thimble and eye bolt for coupling the Glas-Line guy wire to a tree.

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TC 2 $4.20—TC 3 $4.75—Spinner Handle 75c extra

Add 8¢ for Parcel Post

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KORD-ALL, 1274 Edgewood NE, Warren, Ohio

ATTENTION MOBILEERS

Positive band change in an instant with *Autenna!*

See Page 94, Sept. 1957 CQ

RAFRED ENTERPRISES Box 47725, Wagner Station Los Angeles 47, California

SWR Monitor [*from page 97*]

imum and the power turned on. The rectifier at the load or antenna end delivers the SWR indication while the other switch position reads relative power output. The potentiometer is slowly advanced with the switch in the power or "check" position to set a full scale reading and then the switch is flipped to the SWR or "read" side.

On 14 mc, and using a standard 100 *uA* meter in conjunction with the unit described, the meaning of the current readings in SWR was found to be in accordance with the values shown in the chart below.

SWR	*uA*	*SWR*	*uA*	*SWR*	*uA*
1:1	0	3:1	50	**7:1**	78
1.5:1	**20**	4:1	60	**10:1**	82
2.0:1	**34**	5:1	68	**20:1**	91
2.5:1	**42**	6:1	74	100:1	99

For real deluxe jobs a meter scale can be made to give the readings in SWR directly. On other bands the unit will have to be calibrated at various SWRs if a direct indication is desired. However, because it is the lowest or minimum reading that is of interest, a universal volt-ohmmeter can be used with the detector to show the approximate SWR values and eliminate the need for accurate calibration.

Now, a word about the performance of the device. The writer has used a unit similar to the one described for over six months. In that time antennas on the 15, 20 and 40 meter bands were checked. In particular it was most useful in tuning up a ⅝ wave ground plane used on both 20 and 40 with a coupling network at the base of the tower. Because this network had to match a rather unusual length (40 ft.), the adjustments were not at all obvious. Yet with this SWR meter the tune-up could be made in a few seconds.

Of even greater value were the numerous times the SWR monitor gave instant indication of the fact that the 15 meter antenna was connected to the rig with the final tuned to 20! Other malfunctions such as water in the tuning network and a broken lead to the tower were also detected immediately without a long period of transmitting at a high SWR. The savings in possible damage to the co-ax line and fittings are obvious.

With the switch reading power, practically all tune-up adjustments on the transmitter can be made. In fact, except to get a general idea of power input, the plate meter on the final is not nearly as good an indication of overall transmitter performance as is the SWR monitor.

After a few hours experience with this device it is a good bet that this "attachment" to the modern transmitter will become the most important addition since the low pass filter! ■

Model 26 [*from page 90*]

wider this span, the better adjusted your machine is and it will also be more tolerant of defective signals. A small narrow range indicates possible:

Distorted, defective RTTY signals
A poor terminal unit
A misadjusted machine

By persistent monkeying with my 26's selector magnet and armature return spring tensions, I have achieved a local copy range of 20-110 which is about par for the course. The lever is left set at 60 which is midway. Distorted RTTY signals will have reduced spans, of course. Different stations will often have different ranges depending upon the quality of their signals. A slight movement of the pointer may clear up a difficult station by moving the sampling spot to an undistorted portion of that station's signals. The pointer is often used in that way to compensate for distorted pulses in commercial wire services where the inductive kick of telegraph lines is a problem.

I have discovered that altering the armature return tension will push the range adjustments up or down the scale somewhat. So if one of your range limits appears to be way off the scale, try experimenting and perhaps it can be shifted back onto the 0-120 scale as well as improving the span.

4. Lubrication—Squirt anything that dares to move with No. 10 motor oil. Don't miss two small oil cups that are in the depths of the printer. Use discretion. Too much oil attracts dust. Keep the cover on to minimize dust. The motor requires light grease with a special gun at the end bells. Don't let clutches get dry. When they look dry, it's time to oil.

5. Stray Information—A 3 volt battery in series with keyboard and magnets produces lousy local copy because for some reason—["the machine hates a 'tight,' well regulated supply"—W2TKO.] A poor, 'loose' supply like a 45 Volt battery with dropping resistor down to 20 ma., works fine.

Don't feel bad if you can copy only one in ten of the commercial stations heard. Most of them are either working faster speeds or multiplexing.

NOW THEN: You say you've done all these things and your 26 still prints –¼&½QEUT-ZLPOP . . . and the printer is dripping oil and ink all over the carpet and scraps of dirty RTTY paper all over the floor. You say the last time parts were lost was when the 26 fell on the floor and that your XYL threatens to houseclean the whole mess out of the house, if she doesn't get a divorce first. . . .

Tell you what to do—don't, don't write me, but do write all your troubles to W9TCJ, WØBP, W2TKO, and W6AEE. When they angrily besiege the house, I'll write another RTTY article. ■

Crystals! Guaranteed!!
We Got 'Em!

3005 3800 4900 5873 5 6350 6973 3 7350 7520 7640 7860 8090 8300 8560
3010 3885 4930 5875 6362 6975 7358 3 7525 7641 7 7866 7 8091 7 8306 6 8566 7
3015 3955 4950 5880 6373 3 7000 7366 7 7530 7650 7870 8100 8308 3 8570
3020 3980 4980 5892 5 6375 7006 6 7373 3 7533 3 7658 3 7873 3 8106 6 8310 8573 3
3025 3990 4995 5900 6400 7025 7375 7540 7660 7875 8108 3 8316 7 8575
3030 3995 5030 5906 7 6405 7040 7383 3 7541 7 7666 7 7880 8110 8320 8580
3035 4035 5035 5907 5 6406 6 7050 7400 7550 7670 7883 3 8116 7 8325 8583 3
3040 4045 5090 5925 6425 7073 3 7406 7558 3 7673 3 7890 8120 8330 8590
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3135 4280 5485 6042 6575 7720 7940 8170 8425 8640
3140 4295 5500 6050 6600 7770 7941 7 8173 3 8430 8641 7
3145 4300 5545 6073 3 6606 6 7773 3 7950 8175 8433 3 8650
3150 4330 5582 5 6075 6625 7775 7958 3 8180 8440 8658 3
3155 4340 5587 5 6100 6640 7725 7960 8183 3 8441 7 8660
3160 4395 5645 6106 6 6650 7730 7966 7 8190 8450 8666 7
3165 4397 5 5660 6125 6673 3 7733 3 7970 8191 7 8458 3 8670
3170 4445 5675 6140 6675 7740 7973 3 8200 8460 8673 3
3175 4490 5687 5 6142 6700 7741 7 7975 8206 6 8470 8675
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3205 4535 5706 7 6173 3 6725 7760 7983 3 8210 8475 8683 3
3210 4540 5725 6175 6740 7766 7 7990 8216 7 8480 8690
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3225 4610 5740 6200 6773 3 7125 7425 7573 3 7783 3 8000 8225 8490 8700
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FT-243 2-3 Meg. in steps of 5 KC $1.49

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FT-241 SSB. Matched Pairs.....pr. $1.95
FT-241 Single Side Band low frequency Crystals—
370 KC to 540 KC.....ea. 49c
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160 Meter—FT243 1005 to 1999 KC.....ea. $1.99

1000 KC-DC9-LM-BC 221 Std.....$6.25

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U. S. CRYSTALS, INC.
1342 So. La Brea Ave., Los Angeles 19, Calif.

For further information, check number 66 on page 206.

a jumper which tied the screen-grids in parallel.

Because this transmitter employed a 250-watt class B modulator, the af grid driving voltage to this unit could be utilized by connecting a pair of clip leads to the grids of the modulator tubes and pulling these tubes from their sockets. The secondary center tap of the modulator driver transformer was then connected to ground. This driver transformer was set for maximum step-up ratio, primary (500 ohms) to ½ secondary of 1:3. In the final setup, the push-pull 6V6 class AB1 amplifier produced more af voltage than was required.

Because some operational tests appeared to be in order at this point a dummy load consisting of two 100-watt lamps in parallel was connected to the amplifier output. The exciter was tuned up in the 40-meter phone band, and the 813 amplifier input circuit was tuned and adjusted for *normal class C operation*. The final amplifier plate voltage was gradually applied to the plate circuit. At 2200 volts the static plate current was too high, about 200 milliamperes. Negative voltage was then applied to the screen grids (about –90 volts). This voltage cut the plate current off completely. Next, the speech amplifier was turned on and, with the plate tank tuning capacitor and loading capacitors set near their normal tune-up values, the gain control was advanced while the writer whistled into the microphone. The final amplifier plate current gradually increased, and the plate tank circuit was resonated. With loading, the dummy load lamps came to brilliance at a plate current of about 125 milliamperes. An "on the air" check with the SB group produced exciting results. All reports were readability 5, all the way to the West coast. Critical reports indicated excessive carrier, unbalance in the sidebands, and some distortion. Because of the encouraging results obtained with only one evening's work, further work on the system was continued for several weeks. During this period, numerous adjustments and measurements were conducted, and "on the air" tests were made almost regularly with the same group of SB stations. The results of this investigation supplied most of the information contained in this article including the typical operation values for a pair of 813's shown in Fig. 5.

DC Plate Voltage	2250 volts
DC Grid-No. 3 Voltage	0 volts
Grid-No. 2 (Screen-Grid) Voltage:	
DC*	—90 volts
AF° (rms, per tube) approx.	180 volts
DC Grid-No. 1 (Control-Grid) Voltage*	—150 volts
Peak RF Grid-No. 1 Voltage (per tube)	275 volts
DC Plate Current:	
For zero af grid-No. 2 signal, approx.	0 ma
For max. af grid-No. 2 signal, approx.	125 ma
DC Grid-No. 2 Current	#
DC Grid-No. 1 Current $	20 ma
Grid-No. 1 Driving Power, approx.	8 watts
Average Power Output, approx. (total for two tubes)	210 watts

* At W2IYG, —90 volts obtained from common fixed supply. Additional —60 volts for grid No. 1 obtained from resistor of 3000 ohms.
° AF signal of 2 kc.
Negligible
$ DC grid No. 1 current drops 10 to 15% under maximum af signal conditions.

FIG. 5

The following chart clearly shows the power-saving advantage of DSB operation over AM operation:

AM Versus DSB Power Comparisons
(Values are for 813 transmitter at W2IYG under max. af signal conditions

	AM	*DSB-SC*
DC Plate Input Power (Final)	500	281 watts
DC Grid-No. 2 Input Power	32	0 watts
Grid No. 1 Driving Power	8	8 watts
Carrier Power	375	0 watts
Total Sideband Power (Average) for Sine-wave modulation	187	210 watts
DC Modulator Plate Input (including modulator driver)	353	20 watts
Total DC Input Power to Final and Modulator	885	301 watts

Note that the *AM* transmitter requires more than 3 times the total dc input power of the DSB transmitter for *about the same* sideband power! When filament and bias power requirements are included for the AM modulator stage, the figure is closer to 4.

On the Air Operation

For those who have never tuned in a suppressed-carrier signal, double-sideband or single-sideband, your present AM-CW receiver can demodulate a suppressed-carrier signal only when a carrier of sufficient strength and frequency is present at your receiver. To supply this carrier it is only necessary that your BFO be turned on. First, however, the sideband station should be tuned for maximum response. Keep the rf gain *low*, and the af gain high. Turn on the BFO and adjust the pitch control until the signal becomes readable. Adjust the main tuning dial for maximum intelligibility. Slight re-adjustment of the rf and af gain controls and BFO will produce complete readability with no "Donald Duck" effects. This final frequency is the one at which you zero-beat your vfo. The use of a crystal filter or Q-multiplier to improve receiver selectivity aids in the rejection of one of the sidebands and reduces phasing effects. The ideal solution is to add a sideband adapter to the receiver. Stand by until there is a lull in the conversation, then break in with your call. Keep your pencil handy because, if your experience turns out to be like the writer's, you'll have more qrmless qsos in a shorter period of time than you have ever had before. You're on your own! Happy "carrierless" hunting! ■

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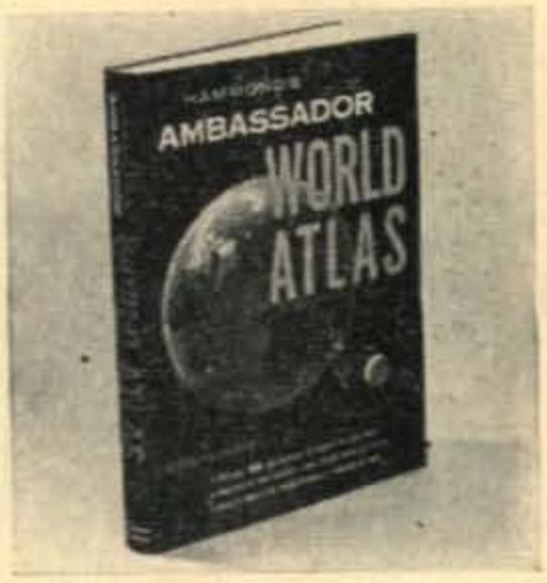

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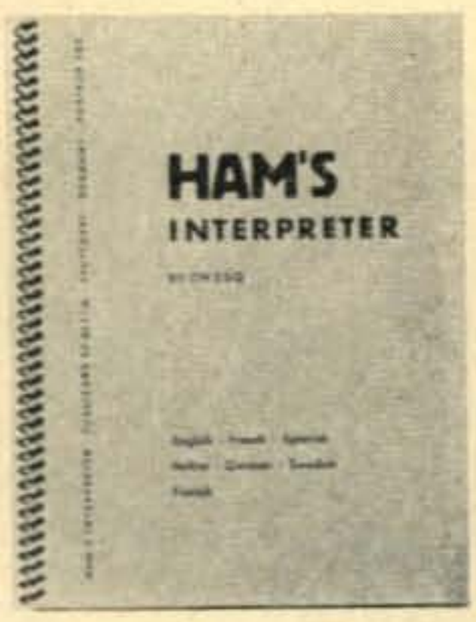

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Acme Electronics Inc. 261
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Alco Electronics 161
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Algeradio Electronics Co. 243
236 N. Franklin Ave.
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Allen & Hurley 237
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Trenton 10, N. J.

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6205 Market St.
Philadelphia 39, Pa.

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Philadelphia 36, Pa.

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4401 Ventnor Ave.
Atlantic City, N.J.

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1133-37 Haddon Ave.
Camden, N. J.

Almo Radio Co. 137
317 Park Heights Ave.
Salisbury, Md.

Almo Radio Co. 324
550 Markley St.
Norristown, Pa.

Almo Radio Co. 238
201-203 Calhoun St.
Trenton, N.J.

Almo Radio Co. 60
1122 French Street
Wilmington, Delaware

Alpha Aracon
29 Adelaide Street, W.
Toronto 1, Ontario, Canada

Amateur Headquarters & Supply 364
P. O. Box 5086
Beacon Hill Station
San Antonio, Texas

Amateur Radio Equipment Co. 121
1203 East Douglas
Wichita, Kansas

Amateur Radio Supply Co. 405
224 Cedar Street
Seattle 1, Wash.

Amateur Supply Co. 349
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Fort Worth 3, Texas

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Lafayette Hill, Penna.

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2330 Kern Street
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Arrow Electronics Inc. 249
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Mineola, L.I., N. Y.

Walter Ashe Radio Company 147
1125 Pine Street
St. Louis 1, Mo.

Associated Electronics Supply 256
1427-29 Sunset Avenue
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Atronic Corporation 104
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Chicago 26, Illinois

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512 Broadway
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Benton Electronic Supply Inc. 173
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Bronx Wholesale Radio 263
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Bronx, N. Y.

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Dunellen, N. J.

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Burghardt Radio Supply 384
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Burstein-Applebee Company 143
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Bushland Radio Specialties 422
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200 Mission Road
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151 Main Street
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1723 W. Fond duLac Ave.
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Certified Electronics 395
1330 Powhatan Street
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Albany Avenue, Ext.
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Channel Radio Supply Co. 45
18 E. Ortega Street
Santa Barbara, Calif.

Chemcity Electronic Dist. 419
1637 Fourth Avenue
Charleston 27, W. Va.

Chemcity Radio & Electric Co. 418
103 Clendenin Street
Charleston, Kanawha City, W. Va.

Chester Electronic Supply Co. 425
2012 - 52nd Street
Kenosha, Wisconsin

Chicago Radio Apparatus Co., Inc. 106
415 South Dearborn Street
Chicago 5, Illinois

Chief Electronics Inc. 251
14 No. Bridge Street
Poughkeepsie, N. Y.

James W. Clary & Co. 2
1713 2nd Avenue, South
Birmingham, Ala.

Coast Radio Co. 406
110 University Street
Seattle 1, Washington

Cobean Stationery Co. 204
320 N. Richardson
Roswell, New Mexico

Congress Radio Co. 57
207 Congress Avenue
New Haven, Conn.

Consolidated Radio Co. 330
Electronic Parts Dist. 330
612 Arch Street
Philadelphia 6, Pa.

Cosmopolitan Radio Co. 92
524 Washington Street
Gary, Indiana

The E. S. Cowie Electric Co. 144
1819-23 Wyandotte Street
Kansas City 8, Missouri

Crabtree's Wholesale Radio 344
2608 Ross Avenue
Dallas 1, Texas

Craddock's Radio Supply 82
P. O. Box 297
Boise, Idaho

Cramer Electronics Inc. 156
811 Boylston Street
Boston 16, Mass.

The Crawford Radio
119-121 John St., North
Hamilton, Ont. Canada

Crescent Radio Supply 122
212 W. 10th Street,
Bowling Green, Kentucky

Curle Radio Supply 385
439 Broad Street
Chattanooga 2, Tenn.

Custom Electronic, Inc. 297
1000 South Main Street
Dayton 9, Ohio

The D & J Electronic Supply Co., Inc. 307
207 Elm Road, S.E.
Warren, Ohio

Dalton-Hege Radio Supply Co. 210
924 West 4th St. (Rear)
Winston-Salem, N. C.

Wm. Dandreta & Co. 372
28 Walcott Street
Providence 8, R.I.

Dealers Wholesale Supply 48
265 South Laurel Street
Ventura, Calif.

David B. Dean & Co. 168
85 Cohannet Street
Taunton, Mass.

Delaware Electronics Supply Co., Inc. 62
220 W. 4th Street
Wilmington, Delaware

DeMambro Radio Supply Co., Inc. 157
1095 Commonwealth Ave.
Boston 15, Mass.

DeMambro Radio Supply Inc. 199
1308 Elm Street
Manchester, N. H.

DeMambro Radio Supply Co., Inc. 169
222 Summer Street
Worcester, Mass.

DeMambro Radio Supply 373
90 Broadway
Providence, R. I.

Denison Radio Supply 346
310 West Woodard Street
Denison, Texas

Diehl Radio & TV Supply 363
2120 7th Street
Port Arthur, Texas

Dixie Radio Supply Co. 378
234 East Evans Street
Florence, South Carolina

Dixie Radio Supply Co., Inc. 206
715 W. Morehead Street
Charlotte, N. C.

Dixie Radio Supply Co. 377
1700 Laurel Street
Columbia, South Carolina

Dixie Radio Supply Co. 379
306 Wade Hampton Blvd.
Greenville, S. C.

Dow Radio, Inc. 33
1759 East Colorado Street
Pasadena 4, Calif.

M. N. Duffy & Co., Inc. 374
2040 Grand River Avenue
Detroit 26, Michigan

W. H. Edwards Co., Inc.
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Providence 3, R. I.

El-A-Co. 302
235 Lodi Street
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Electra Distributing Co. 389
1914 West End Avenue
Nashville 4, Tennessee

Electric Products Sales Co. 180
427 East Michigan Ave.
Lansing 29, Michigan

Electro Sales Co., Inc. 432
50-58 Eastern Ave.
Boston 13, Mass.

Electronic Center, Inc. 189
107 Third Avenue, North
Minneapolis 1, Minn.

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1845 Peck Street
Muskegon, Michigan

Electronic Equipment Co. 351
917-19 Florence Street
Ft. Worth, Texas

Electronic Equipment Distributors 37
1228 - 2nd Avenue
San Diego 1, Calif.

Electronic Equipment & Engineering Co. 342
805 South Staples Street
Corpus Christi, Texas

Electronics Export Co., Inc. 209
Box 1742
Raleigh, N. C.

Electronic Laboratories & Supply Co. 257
1415 Oriskany St., West
Utica 4, N. Y.

Electronic Parts Co., Inc. 201
222 Truman Street, N.E.
Albuquerque, New Mexico

Electronic Parts Co. 353
3505 Crawford
Houston 4, Texas

Electronics Suppliers 13
2428 Shattuck Ave.
Berkeley, Calif.

Electronic Supply 75
61 N.E. 9th Street
Miami 32, Florida

Electronic Supply 74
913 Morningside Drive
Melbourne, Florida

Electronic Supply Corp. 172
94 Hamblin Avenue
Battle Creek, Michigan

Electronic Supply Co. 151
250 Eleventh Street, West
Billings, Montana

Electronic Supply Co. of Petersburg, Inc. 400
13 East Washington St.
Petersburg, Va.

Electronic Tube Co.
464 McGill St.
Montreal, Quebec, Canada

Electronic Wholesalers, Inc. 64
2345 Sherman Ave., N.W.
Washington 1, D. C.

Electronics, Inc. 430
705 So. 3rd Avenue
Wausau, Wis.

Electro Sonic Supply Co., Ltd.
543 Yonge Street
Toronto, Ont., Canada

Elliott Electronics 11
418 N. Fourth Avenue
Tucson, Arizona

Elmar Electronics Inc. 31
140 Eleventh Street
Oakland 7, California

Emco Electronic Wholesalers 138
1123 Fidler Lane
Silver Spring, Md.

Emerson Radio of Connecticut 54
20 Chestnut Street
Hartford 5, Conn.

Emrich Radio Supply 3
656 Dauphin Street
Mobile, Alabama

A. H. Esch & Co., Ltd.
10154 - 102nd Street
Edmonton Alta., Canada

Euclid Radio Parts Corp. 301
16379 Euclid Avenue
East Cleveland 12, Ohio

Evans Radio 394
c/o Burtis W. Dean
25 Bay View Street
Burlington, Vt.

Evans Radio, Inc. 198
P. O. Box 312
Concord, N. H.

Fair Radio Sales Co. 303
132 S. Main Street
Lima, Ohio

Fargo Radio Service Co. 211
515 Third Avenue, North
Fargo, North Dakota

Farnsworth Radio & TV 101
201-205 East Mullan Ave.
Waterloo, Iowa

Federated Purchaser, Inc. 224
1021 U.S. Rte. 22
Mountainside, N. J.

Federated Purchaser Corp. 226
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Federated Purchaser, Inc. 319
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Denver 3, Colo.

Fitzpatrick Electric Supply Co. 184
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Robert E. Franklin Co. 354
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53 Vesey Street
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G. & G. Radio Supply Co.
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Tacoma, Wash.

W. A. Geiger Radio 415
P. O. Box 660
Ellensburg, Washington

General Distributing Corp. 72
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Ft. Lauderdale, Fla.

General Electronics Distributors, Inc. 420
735 Main Street
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General Radio Supply Co. 217
600 Penn Street
Camden 2, N. J.

Genesee Radio & Parts Co., Inc. 241
2550 Delaward Avenue
Buffalo 3, N. Y.

The J. K. Gill Co. 315
408 S.W. Fifth Avenue
Portland 4, Oregon

Goddard Dist., Inc. 80
1309-1311 N. Dixie
P. O. Box 829
West Palm Beach, Fla.

Eugene Fred Golla 32
1173 Orr Ave.
Kittanning, Pa.

Goodenough Radio Supply 424
210 W. Milwaukee
Janesville, Wisconsin

Gopher Electronics Co. 193
370 Minnesota Street
St. Paul 1, Minn.

Graham Electronics Supply, Inc. 93
102 S. Pennsylvania St.
Indianapolis 4, Indiana

Grand Central Radio Inc. 271
124 East 44th Street
New York 17, N. Y.

Grice Radio and Electronic Supplies 78
300 East Wright Street
P. O. Box 707
Pensacola, Florida

Gulf Coast Electronics 355
1110 Winbern Street
Houston 4, Texas

E. J. Gustafson Co. 382
15 & Cliff
Sioux Falls, S. D.

H. & H. Electronic Supply Inc. 114
506-510 Kishwaukee St.
Rockford, Illinois

H. & R. Supply Co., Inc. 360
706 Main Street
P. O. Box 329
Lubbock, Texas

Hagerty Radio Supply 18
6826 San Fernando Road
Glendale 1, Calif.

Hall Electric Co. 194
566 No. Robert Street
St. Paul 2, Minn.

Hallmark Electronic Corp. 221
85-87 Monticello Avenue
Jersey City 4, N. J.

Ham n Hi-Fi Inc. 298
826 N. Main Street
Dayton 5, Ohio

The Hargis Co., Inc. 369
P. O. Box 526
Waco, Texas

Hargis-Austins Inc. 340
P. O. Box 716
410 Baylor Street
Austin, Texas

Harris Radio Corp. 423
289 N. Main Street
Fond du Lac, Wisconsin

Harrison Radio Corp. 265
225 Greenwich Street
New York 7, N. Y.

Harrison Radio Corporation 266
114-24 Hillside Avenue
Jamaica 35, N. Y.

Harvey Radio Co., Inc. 267
103 West 43rd Street
New York 36, N. Y.

Hatry of Bridgeport, Inc. 53
2465 Main Street
Bridgeport, Conn.

Hatry Electronic Enterprises 55
Hatry of Hartford, Inc.
203 Ann Street
Hartford 3, Conn.

Hatry of New Haven, Inc. 58
77 Broadway
New Haven, Conn.

Wm. S. Heinman 268
400 East 72nd Street
New York 21, N. Y.

Henry Radio Inc. 24
11240 West Olympic Blvd.
Los Angeles 64, Calif.

Henry Radio 141
221 North Main Street
Butler, Missouri

Henshaw Radio Supply 145
3617 Troost Avenue
Kansas City 9, Missouri

Herman Radio Supply Co. 76
P. O. Box 358
Allapattah Station
Miami 42, Florida

Hershel Radio Co. 175
5245 Grand River
Detroit, Mich.

Holert Electric, Inc. 407
2300 W. Spokane St.
Seattle 6, Wash.

Hub Electronics Corp. 258
249 Tarrytown Road
White Plains, N. Y.

Hudson Radio & Television Corp. 269
37 West 65th Street
New York 23, N. Y.

Hygrade Radio Ltd.
971 Richards Street
Vancouver 2, BC, Canada

Industry Services, Inc. 396
2705 S. Oakland Street
Arlington 6, Va.

Inland Electronic Supply 36
843 Colton Avenue
San Bernardino, Calif.

Iowa Radio Supply Co. 96
508 Third Avenue, S.E.
Cedar Rapids, Iowa

Island Radio Distributors, Inc. 244
412 Fulton Avenue
Hempstead, L.I., N. Y.

John Iverson Co. 212
Minot, North Dakota

John Iverson Co. 213
Mandan, N. Dakota

John Iverson Co. 214
Williston, N. Dakota

J.R.S. Distributors 338
646-48 West Market St.
York Pa.

Jersey Electronics Dist. Co. 231
524 21st Avenue
Paterson 3, N. J.

Johannesen Elec. Co., Inc. 207
312-314 N. Eugene Street
Greensboro, N. C.

Art A. Johnson Sales 115
1117 Charles Street
Rockford, Illinois

Lou Johnson Co., Inc. 318
1051 S. Commercial St.
Salem, Oregon

Kar Radio & Electric Co. 416
P. O. Box 676
12th & Pine St.
Walla Walla, Wash.

Ken-Els Radio Supply Co. 100
428 Central Ave.
Fort Dodge, Iowa

Kenex Supply Co. 21
2030 Pacific Highway,
Lomita, Calif.

Kenyon Radio Supply Co., Inc. 65
2020 14th Street, N.W.
Washington 9, D. C.

Key Electronics 397
126 S. Wayne St.
Arlington, Virginia

John G. Kidd & Son, Inc. 288
626 Vine Street
Cincinnati 2, Ohio

Kierulff Electronics Inc. 25
820-830 W. Olympic Blvd.
Los Angeles 15, Calif.

Klaus Radio & Electric Co. 113
707 Main Street
Peoria, Illinois

Kopelove Electronics Co. 299
1939 East First Street
Dayton, Ohio

Ladd Electronics Co. 197
111 No. 41st Street
Omaha 31, Nebraska

Lavender Radio & TV Supply, Inc. 368
520 East Fourth
P. O. Box 1168
Texarkana, Ark. Tex.

L. & M. Sales Co. 370
1307 Austin,
Waco, Texas

Lafayette Radio Corp. 233
139 West Second Street
Plainfield, N. J.

Lakeland Radio Supply 86
P. O. Box 330
Angola, Indiana

Lamp's 'Lectronics Ltd. 366
P. O. Box 5086
Beacon Hil Station
San Antonio 1, Texas

Leader Electronics 272
215 Fulton Street
New York, N. Y.

Leonard Radio Corp. 273
69 Courtlandt Street
New York, N. Y.

Leuck Radio Supply 196
243 S. 11th Street
Lincoln, Nebraska

Lifsey Distributing Co. 178
726 N. Saginaw Street
Flint 3, Michigan

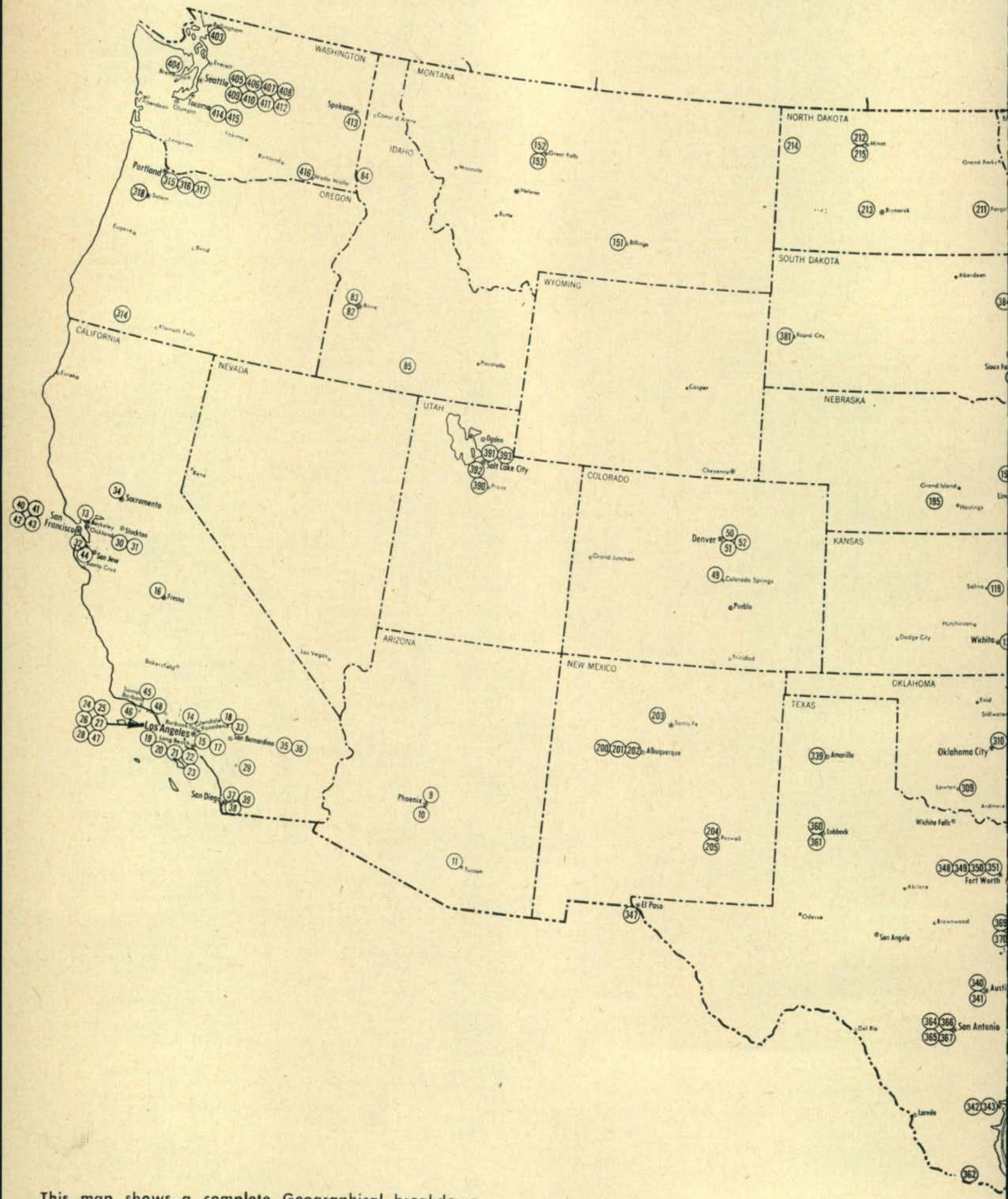
Linear Electronics Co. 433
109-111 Hammond St.
Waltham 54, Mass.

Aaron Lippman & Co. 225
99-107 Newark Street
Newark 4, N. J.

Long Island Radio Co. 356
8309 Lockheed Street
Houston 17, Texas

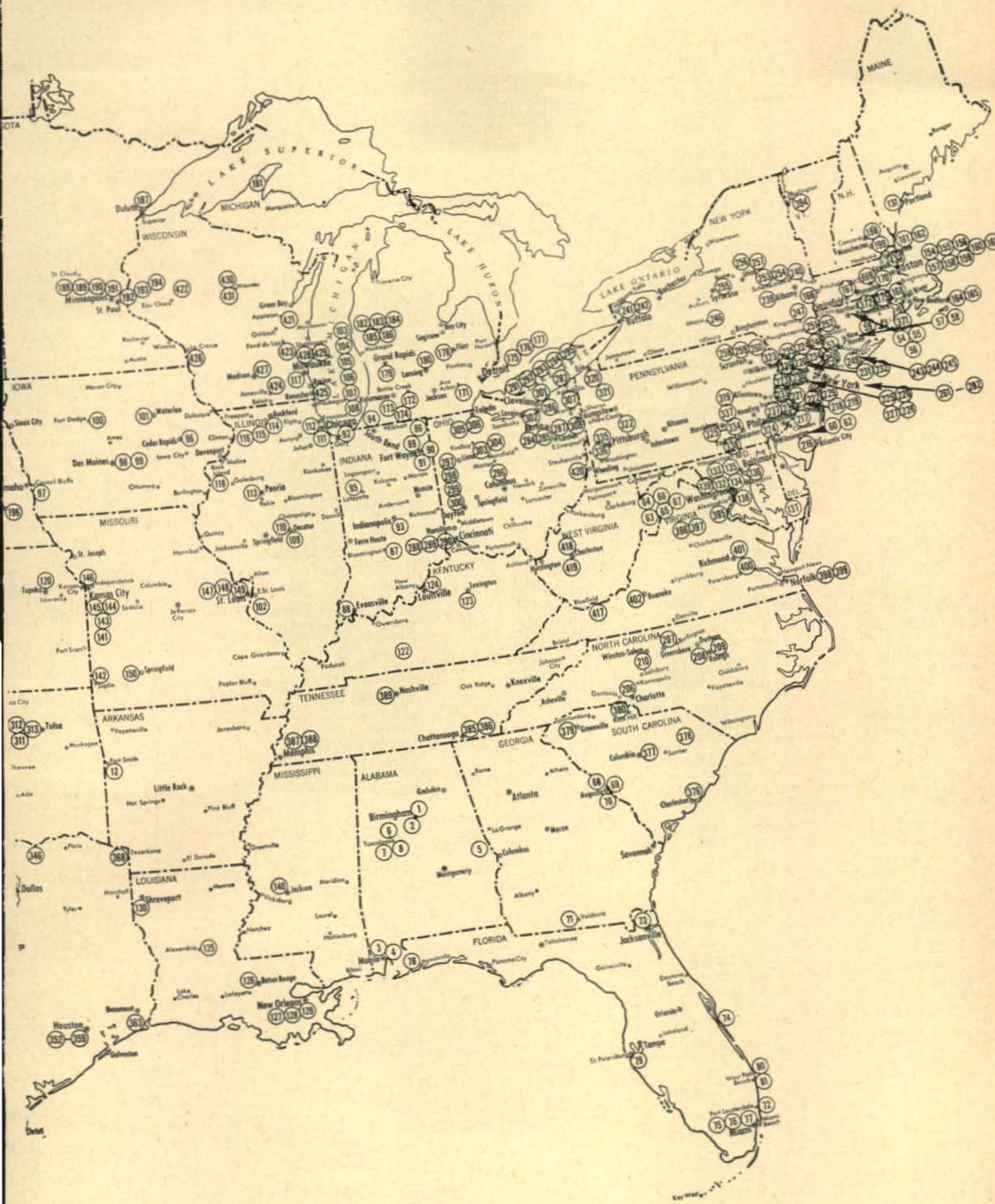
(Continued on page 188)

THIRTY MILLION



This map shows a complete Geographical breakdown of **HAM DISTRIBUTORS**—for alphabetical listing corresponding to the assigned numbers—please see the preceding pages.

DOLLARS A YEAR!*



*According to CQ survey will be spent by Hams in 1958.

(from page 185)

Louisiana Radio & Television Distributors, Inc. 126
1645 Plank Road
Baton Rouge, Louisiana

W. H. Lowdermilk & Co. 66
715 12th Street, N.W.
Washington 4, D. C.

Lowman & Hanford Co. 408
1515 Second Avenue
P. O. Box 1888
Seattle 11, Washington

Lurtz Electric Co. 102
219-221 No. Illinois St.
Belleville, Illinois

Larry Lynde Electronics 22
1526 East Fourth Street
Long Beach 12, Calif.

A. C. McClurg & Co. 107
333 E. Ontario Street
Chicago 11, Illinois

Mac's Radio Supply 47
8320-22 Long Beach Blvd.
South Gate, Calif.

Malone Electronics, Inc. 111
123 N. Addison Avenue
Elmhurst, Illinois

Manwill Supply Co. 390
168 No. 2nd West,
Provo, Utah

Maritime International Co. 274
11 State Street
New York 4, N. Y.

Bill Martindale 46
206 Santa Monica Blvd.
Santa Monica, Calif.

Maytag Electric Co. 215
Box 672
Minot, North Dakota

Melrose Sales Co. 163
467 Franklin Street
Melrose 77, Mass.

Melville Radio Corp. 259
259 Mamaroneck Avenue
White Plains, N. Y.

Melvin Electronics, Inc. 112
238 Chicago Avenue
Oak Park, Illinois

Meyers Electronics, Inc. 417
813 Bluefield Avenue
Bluefield, West Va.

Midway Radio & Television Corp. 275
60 West 45th Street
New York 36, N. Y.

Mid-West Associated Inc. 116
506 Walnut Street
Rockford, Illinois

Miller Research Labs 117
5529 S. 5th Street
Milwaukee 7, Wisconsin

Milo Radio & Electronics Corp. 276
200 Greenwich Street
New York 7, N. Y.

Modern Electronics Co. 367
P. O. Box 1361
San Antonio 6, Texas

Modern Equipment Co. 152
113 Central Ave.
Great Falls, Mont.

Moore Radio Supply 391
147 E. 6th So.
Salt Lake City, Utah

Morrison's Radio Supply 83
331 Center Street
Ashtabula, Ohio

Murray Radio Co. 49
9 East Vermijo
Colorado Springs, Colo.

The Mytronic Co. 289
2145 Florence Avenue
Cincinnati 6, Ohio

N. R. M. Wholesale Radio, Inc. 234
284 Teaneck Road
Ridgefield Park, N. J.

National Electronics 232
216 17th Ave.
Paterson, New Jersey

Nelson Radio & Supply Co., Inc. 4
451 St. Louis Street
Mobile, Ala.

Newark Electric Co. 108
223 West Madison Street
Chicago 6, Illinois

Niagara-Concord Corp. 277
55 Vesey Street
New York 7, N. Y.

Nidisco Jersey City, Inc. 222
713 Newark Avenue
Jersey City 6, N. J.

Nidisco Passaic, Inc. 230
294 Passaic Street
Passaic, New Jersey

Northwest Electronics, Inc. 413
N. 102 Monroe Street
Spokane 1, Washington

Northwest Radio 187
123 East First Street
Duluth 2, Minn.

Northwest Radio & Electronic Supply 190
52 S. 12th Street
Minneapolis 3, Minn.

Northwest Radio of Michigan 181
435 Tamarack Street
Laurium, Michigan

Northwestern Radio Co. 304
131 S. Elizabeth Street
Lima, Ohio

O'Loughlin's 392
118 East Third South St.
Salt Lake City 1, Utah

Offenbach & Reimus Co. 40
1564 Market Street
San Francisco 2, Calif.

Oil Capitol Electronics Corp. 311
P. O. Box 2646
Tulsa 1, Okla.

Olson Radio Warehouse, Inc. 284
73 E. Mill Street
Akron 8, Ohio

The Overton Electric Co. 120
522 Jackson Street
Topeka, Kansas

Pacific Electronics Sales Co. 409
1209 1st Avenue
Seattle, Wash.

Park Electronic Corp. 223
187 Speedwell Avenue
Morris Plains, N. J.

Payette Radio Ltd.
730 St. James Street, W.
Montreal 3, Que., Canada

Peerless Radio Distributors, Inc. 278
92-32 Merrick Road
Jamaica 33, L.I., N. Y.

Pembleton Laboratories 90
E. Columbia at Barr St.
Fort Wayne 2, Indiana

Peninsula Stationers 404
322 Pacific Avenue
Bremerton, Wash.

Peoples Radio & TV Supply Co. 402
1015 Moorman Rd., N.W.
Roanoke, Va.

Pioneer Electronic Supply Co. 291
2115 Prospect Avenue
Cleveland 15, Ohio

Pittsfield Radio Co. 166
41 West Street
Pittsfield, Mass.

Portland Radio Supply Co. 316
1234 S.W. Stark Street
Portland 5, Oregon

Ports Electronics Part Co. 130
309 Airport Drive
Shreveport, La.

Power City Radio Company 381
263 East Main Street
Rapid City, S. Dakota

Power City Radio Company 383
209 S. First Avenue
Sioux Falls, S. Dakota

Prestwood Electronics Co. 69
1445 Greene Street
Augusta, Georgia

Progress Radio Supply Co. 292
413-415 Huron Road
Cleveland 15, Ohio

Purchase Radio Supply 171
327 E. Hoover Avenue
Ann Arbor, Michigan

Frank Quement, Inc. 44
161 W. San Fernando St.
San Jose, Calif.

R & R Supply Co., Inc. 361
Box 1360
Lubbock, Texas

Radelco, Inc. 250
246 West First Street
Mt. Vernon, N. Y.

Radio, Inc. 312
1000 South Main Street
Tulsa, Okla.

Radio Distributing Company 94
1212 High Street
South Bend 24, Indiana

Radio Electric Service Co., Inc. 218
513 Cooper Street
Camden 2, N. J.

Radio Electric Service Co. 134
5 North Howard Street
Baltimore 1, Maryland

Radio Electric Service Co. Of Penna. Inc. 332
701 Arch Street
Philadelphia 6, Pa.

Radio & Electronic Parts Corp. 293
3235 Prospect Avenue
Cleveland 15, Ohio

Radio Electronic Sales Co. 170
52 Chandler Street
Worcester 2, Mass.

Radio Equipment Co. 202
523 E. Central
Albuquerque, N. Mexico

Radio Equipment Co., Inc. 398
821 West 21st Street
Norfolk 10, Virginia

Radio Equipment Corp. 242
312 Elm Street
Buffalo 3, N. Y.

Radio Equipment Co. 123
480 Skain Avenue
Lexington, Ky.

Radio Ham Shack, Inc. 279
189 Greenwich Street
New York, N. Y.

Radiolab 146
1612 Grand Avenue
Kansas City 8, Missouri

Radio Laboratories 376
215 King Street
Charleston 5, S. C.

Radio Parts Co. 429
940 N. 27th Street
Milwaukee 8, Wisconsin

Radio Parts, Inc. 7
402 20th Ave.
Tuscaloosa, Ala.

Radio Parts Co. 295
1950 East 105th Street
Cleveland 6, Ohio

Radio Parts Company 357
902 Crawford Street
Houston 3, Texas

Radio Parts, Incorporated 127
807 Howard Avenue
New Orleans 12, La.

Radio Parts, Inc. 179
542-548 Division Ave., S.
Grand Rapids, Michigan

Radio Parts Dist. Co. 399
128 West Olney Road
Norfolk 10, Virginia

Radio Parts of Arizona 9
P. O. Box 6345
Phoenix, Arizona

Radio Products Sales Inc. 26
1501 South Hill Street
Los Angeles 15, Calif.

Radio Products Sales Co. 51
1237 16th Street
Denver 2, Colorado

Radio Products Sales Co., Inc. 410
1214 First Avenue
Seattle 1, Wash.

Radio Service Laboratory 131
1004 Congress Street
Portland, Maine

Radio Service & Supply Co., Inc. 431
615 Third Street
Wausau, Wisconsin

Radio Shack Corp. 158
167 Washington Street
Boston 8, Mass.

Radio Specialties Co. 176
456 Charlotte Avenue
Detroit 1, Michigan

Radio Supply, Inc. 310
724 N. Hudson
Oklahoma City, Okla.

Radio Supply Co., Inc. 401
3302 W. Broad Street
Richmond 21, Virginia

Radio & Television Distributing Co. 174
1331 M-139,
Benton Harbor, Michigan

Radio Trade Supply Co. 99
1216-23 Grand Avenue
Des Moines 9, Iowa

Radio & TV Clinic 133
2203 N. Fulton Ave.
Baltimore 17, Maryland

Radio Wire Television Inc. of N. J. 227
24 Central Avenue
Newark 2, N. J.

Radio Wire Television Inc. 159
110 Federal Street
Boston 10, Mass.

Radio Wire Television Inc. 280
100 Sixth Avenue
New York 13, N. Y.

Ramsdale & Kunkel 321
1262 Liberty Street
Franklin, Penna.

Harry Reed Radio & Supply Co. 150
805 Boonville Avenue
Springfield, Missouri

Reeves Radio Supply 347
720 N. Stanton Street
El Paso, Texas

Reid Sexton Corp. 8
1711 Greensboro
Tuscaloosa, Ala.

Reno Radio Company 177
1314 Broadway
Detroit 26, Mich.

Rex Radio Supply Co. 281
88 Cortlandt Street
New York 7, N. Y.

Reynolds Radio Suppy 309
909½ C Avenue
Lawton, Okla.

Rio Radio Supply Co. 362
P. O. Box 168
McAllen, Texas

Robbie's Radio Supply 83
40th & Hill Rd., Rte. 3
Boise, Idaho

A. H. Roemer Co., Inc., 236
39 Maple Street
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Whether you phone, order by mail, or drop in, you can depend on HARVEY that you receive exactly what you ordered, and that it will function and perform to your complete satisfaction. You also receive the friendly reliable service you'd expect from fellow hams . . . with years of experience . . . catering to the needs of hams the world over.

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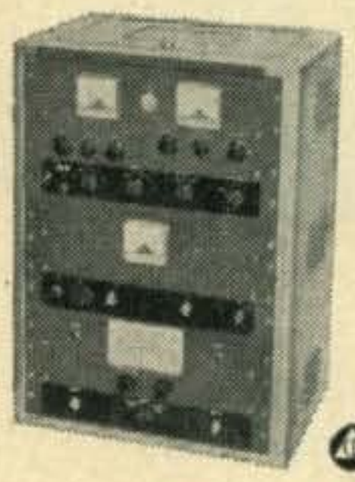
For further information, check number 68 on page 206.

BEFORE YOU BUY OR TRADE ANY HAM GEAR SEE WARD W2FEU

FOR THIS TOP WRL ELECTRONICS GEAR!

Globe King 500B

Bandswitching 10-160 Xmttr. for 540 W. on fone & CW; 750 W. on SSB (P.E.P.) with any 10W external exciter. Relay-controlled; includes built-in antenna relay, built-in VFO, and separate power supply for modulator section allowing better overall voltage regulation. Commercial type compression circuit keeps modulation at high level. Features grid-block keying. Pi-net matches most antennas, 52-600 ohms. Provisions for crystal operation.



Net: **$725.00**

Globe Champion 300

Single-switch bandswitching Xmttr., 10-160M, for 350 W. CW, 275 W. fone, 500 W. SSB (PEP), with 10W external exciter. Extensively TVI-suppressed, filtered & by-passed. High level Class "B" modulation without usual clipping distortion with commercial type compression circuit. Pi-net output 48-700 ohms, built-in VFO, push-to-talk, antenna changeover relay and time-sequence keying.

Wired & Tested: **$449.00**

Kit: **$375.00**

Globe Scout 680

Compact, self-contained, bandswitching Xmttr. for 65 W. CW, 50 W. fone, plate modulated, on 6-80M. Built-in power supply. High level modulation. TVI-suppressed cabinet. Pi-net output on 10-80M; link coupled on 6M, matching into low impedance beams. Globe Scout 66 is identical, except bandswitching 10-160M, wired only, $99.95.

Wired & Tested: **$109.95**

Kit: with wired VFO **$375.00**

FCDA Certified on factory wired and tested models for crystal controlled operation.

AND MORE:

Globe Chief, Model 90, **$67.50** (Kit: **$54.95**)
New WRL Linear Amplifier LA-1, **$124.50** (Kit: **$99.50**)
Globe Matcher Jr. Antenna Tuner, **$15.95** (Kit: **$11.95**)

For Complete Information:

See WARD — W2FEU

ADIRONDACK RADIO SUPPLY

Telephone Victor 2-8350

185 West Main St. — Amsterdam, New York

For further information, check number 69 on page 206.

HAM DISTRIBUTORS

Rogers Radio Co. 52
1648 Wazee Street
Denver 2, Colorado

E. A. Ross & Co. 165
1663 Purchase Street
New Bedford, Mass.

Ross Radio Co. 308
325 W. Federal St.
Youngstown 3, Ohio

Roswel Electronic Sales & Service Co. 371
P. O. Box 552
Pawtucket, Rhode Island

306 Prospect St. 160
Cambridge, Mass.

S. & S. Radio Supply 313
537 S. Kenosha
Tulsa 3, Okla.

Sacramento Amateur Radio & TV Supplies 34
300 Capitol Avenue
Sacramento, Calif.

San Francisco Radio & Supply Co. 41
1284 Market Street
San Francisco 2, Calif.

Satterfield Electronics, Inc. 427
326-328 W. Gorham St.
Madison 3, Wisconsin

H. R. Savard Radio Ltd.
910 Bleury
Montreal 1, Que., Canada

R. G. Scell & Co., Inc. 56
78 Maple Avenue
Hartford 14, Conn.

Schenectady Electronic Dis. Corp. 254
1708 Altamont Avenue
Schenectady, New York

M. Schwartz & Son 253
710-712 Broadway
Schenectady 5, N. Y.

Scott Radio Supply, Inc. 23
266 Alamitos Avenue
Long Beach 2, California

Seattle Radio Supply Inc. 411
2117 2nd Avenue
Seattle 1, Washington

Selectronic Supplies, Inc. 305
1320 Madison Avenue
Toledo, Ohio

Shanks & Wright 39
2045 Kettner Blvd.
P. O. Box 63
San Diego 1, Calif.

Siler's Inc. 128
333 St. Charles Street
New Orleans 12, La.

Smalley's Radio Ltd. 1105 7th Avenue, West
Calgary, Alberta,
Quebec, Canada

Smith Supply Co. 153
808 Central Avenue
Great Falls, Montana

Southern Electronics Corp. 5
303 South 10th St.
Opelika, Ala.

Southern Radio Supply Co. 129
1900 Tulane Avenue
New Orleans 16, La.

Southwest Radio Supply 345
1820 N. Harwood St.
Dallas 1, Texas

Southwest Wholesale Radio, Inc. 10
P. O. Box 3647
Phoenix, Arizona

Southworth's 95
308-10 State Street
West Lafayette, Indiana

Specialty Distributing Co., Inc. 71
916 Marion Street
Valdosta, Georgia

Specialty Distributing Co., Inc. 70
644 Reynolds Street
Augusta, Georgia

Specialty Distributing Co., Inc. 68
425 Peachtree St., N.E.
Atlanta 3, Georgia

Specialty Distributing Inc. 386
135 Market Street
Chattanooga, Tenn.

Springfield Radio Co., Inc. 167
405 Dwight Street
Springfield 3, Mass.

Srepco, Inc. 300
314 Leo Street
Dayton 4, Ohio

Roy C. Stage, Distributor 255
265 Erie Boulevard, West
Syracuse, N. Y.

Stallman Of Ithaca, Inc. 246
123-131 So. Tioga St.
Ithaca, N. Y.

Standard Parts Corp. 245
277 North Franklin St.
Hempstead, N. Y.

Standard Supply Co. 393
225 East 6th South
P. O. Box 1047
Salt Lake City 10, Utah

Stansifer Radio Co. 87
343 S. Rogers Street
Bloomington, Indiana

Harry Stark's Inc. 191
71 South 12th Street
Minneapolis 3, Minn.

The Stark Radio Supply Co. 426
131 South 6th Street
La Crosse, Wisconsin

Albert Steinberg & Co. 333
2520 North Broad St.
Philadelphia 32, Penna.

Sterling Radio Products Co. 358
P. O. Box 1746
Houston 1, Texas

J. V. Stout Co. 135
4640 York Road
Baltimore 12, Maryland

Sun Parts Distributors, Ltd. 67
514 10th Street, N.W.
Washington 4, D. C.

The Sun Radio Co. 285
110 East Market Street
Akron 8, Ohio

Supreme Radio Supply 205
129 West 2nd Street
Roswell, New Mexico

Swan Distributing Co., Inc. 140
342 N. Gallatin Street
P. O. Box 2698
Jackson, Mississippi

TAB 282
111 Liberty Street
New York, N. Y.

Taylor, Pearson & Carson
1006 Richards Street
Vancouver 2, BC, Canada

The Technical Material Corp. 248
700 Fenimore Rd.
Mamaroneck, N. Y.

Telcoa 28
22,221 Pacific Coast Highway
Malibu, Calif.

Teleradio Inc. 142
1610 Main
Joplin, Missouri

Teletronic Supply Co. 290
3919 Montgomery Rd.
Norwood
Cincinnati 12, Ohio

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75A-4 SSB Receiver

Designed expressly for operation on the 7 HF Amateur bands. Features AVC on SSB and CW, separate detectors for AM and SSB, passband tuning, rejection tuning, Gear Reduction Tuning Knob, superior selectivity and many other time-proven Collins features.
75A-4 Receiver, Net Price $695.00

KWM-1 SSB Mobile Transceiver

First mobile transceiver in the Amateur field — 175 watts PEP input, 14-30 mc. Use for mobile or fixed station without modification.
KWM-1 Transceiver, Net Price $770.00

for the top performing Amateur kilowatt...
Collins
KWS-1

Unmatched performance, accuracy and stability characterize the Collins KWS-1 in SSB, AM or CW operation. Extremely accurate 70E VFO. Pi-L output network. Collins Mechanical Filter. See us about generous trade-in allowance and time payment terms.
KWS-1 kilowatt Transmitter,
Net Price $2,095.00

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ELECTRONIC WHOLESALERS, INC.
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For further information, check number 70 on page 206.

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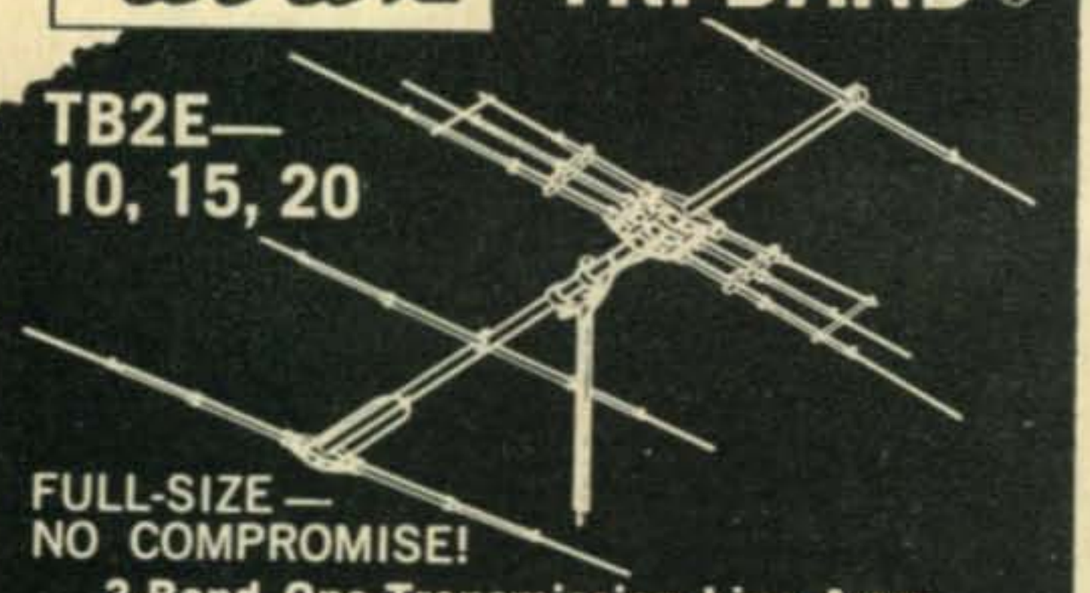

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Price: $158.00

Order today from —

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Bill Lucas — W7AEF
Portland Radio Supply
1234 S.W. STARK
PORTLAND 5, OREGON

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IS THE PLACE TO BUY

Collins EQUIPMENT

KWS-1
1 kilowatt Transmitter
w/Power Supply $2,095.00
75A-4 SSB Receiver $695.00
KWM-1 SSB
Mobile/Fixed Station
Transceiver $770.00
and a complete stock
of all Collins accessories.
Liberal trade-in allowance.
Convenient Time Payment Plan.

DALTON-HEGE
RADIO SUPPLY CO., INC.
912 West 4th St. Winston-Salem, N.C.

For further information, check number 72 on page 206.

HAM DISTRIBUTORS

Television Accessory House, Inc. 375
41-45 Broadway
Providence, R. I.

Television Radio Supply Co. 42
1321 Mission Street
San Francisco, Calif.

Texas Electronic Supply, Inc. 341
P. O. Box 764
Austin, Texas

Bill Thompson Radio Supply 15
1154 W. Washington Blvd.
Culver City, Calif.

Tri-City Radio Supply Inc. 118
1919 4th Avenue
Rock Island, Illinois

Tydings Company 336
5930 Baum Blvd.
Pittsburgh 6, Penna.

Uncle George's Radio Ham Shack 139
514 Forest Glen Road
Silver Spring, Md.

United Electronics Wholesale 85
328 3rd Street, E.
Twin Falls, Idaho

United Radio & Electronics Co. 17
122 So. Pomona Avenue
Fullerton, Calif.

United Radio & Electronics Co. 27
1924 South Grand Avenue
Los Angeles 7, Calif.

United Radio Supply Inc. 317
22 N. W. 9th Avenue
Portland 9, Oregon

Universal Distributors, Inc. 20
4642 W. Century Blvd.
Inglewood 2, Calif.

Universal Radio Supply Co. 124
533 South Seventh Street
Louisville 3, Kentucky

Universal Service 296
114 North Third Street
Columbus 15, Ohio

Valley Electronic Supply Co. 14
1302 W. Magnolia Blvd.
Burbank, Calif.

Valley Engineering Co. 203
601 Cedar Street
Los Alamos, New Mexico

Valley Radio Distributors 421
518 North Appleton Street
Appleton, Wisconsin

Van Sickle Radio Co. 149
1113 Pine Street
St. Louis 1, Missouri

Van Sickle Radio Supply Co. 91
1320 So. Calhoun Street
Fort Wayne, Indiana

Variety Electric Co., Inc. 228
468 Broad Street
Newark 2, N. J.

Vaughn & Wright 81
524 First Street
West Palm Beach, Fla.

Victory Specialties Co., Inc. 252
Dutchess Turnpike
Poughkeepsie, N. Y.

W & W Distributing Co. 388
P. O. Box 436
644 Madison Avenue
Memphis, Tenn.

Waltkus Supply Co. 403
110 Grand Avenue
Bellingham, Wash.

Walder Radio & Appliance Co. 77
1809 N. E. Second Ave.
Miami 32, Florida

Ver G. Walker Co. 314
P. O. Box 1586
Medford, Oregon

Warren Radio Company 306
1320 Madison Avenue
Toledo 2, Ohio

Warren Radio, Inc. 320
1313 Peach Street
Erie, Penna.

Welch Radio Supply Co. 287
408 - 9th Street, South
St. Petersburg, Fla.

Western Electronic Supply Co. 185
1781 Fifth Street
Muskegon, Michigan

Western Electronic Supply Co. 186
517 W. Broadway
Muskegon Heights, Mich.

Western Electronic Supply Co. 412
717 Dexter Avenue
Seattle 9, Washington

Western Radio 195
Kearney, Nebraska

Western Radio and Television Supply Co. 38
1415 India Street
San Diego 1, California

West Texas Radio Supply 339
1026 West 6th, Box 1578
Amarillo, Texas

E. C. Wharfield Radio Prod. Sales Co.
1237 16 St.,
Denver 2, Colo.

Wholesale Radio & Elec.
1143 Bay Street
Toronto 5, Ont. Canada

Wholesale Radio Parts, Co., Inc. 136
308-310 W. Redwood St.
Baltimore 1, Maryland

Wicks Radio Equipment Co. 343
513-15 S. Staples
Corpus Christi, Texas

Wilson Radio Supply Co. 43
1001 Towson Avenue
Fort Smith, Ark.

Wofford Electronics Parts 359
3508 Crawford
Houston 4, Texas

World Radio Laboratories, Inc. 97
3415 W. Broadway
Council Bluffs, Iowa

Yale Radio Electric Company 19
6616 Sunset Blvd.
Hollywood 28, Calif.

York Radio & TV Corp. 110
801 North Broadway
Decatur, Illinois

York Radio & TV 109
518 E. Prairie
Decatur, Illinois

Young & Young, Inc. 162
262 Lowell Street
Lawrence, Mass.

Yukon Radio Supply, Inc.
P. O. Box 406
Anchorage, Alaska

Zack Radio Supply Co. 43
1424 Market Street
San Francisco 2, Calif.

Zack Radio Supply 52
225 Hamilton Avenue
Palo Alto, Calif.

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"In the many hours my Collins 75A-4 and KWS-1 have been on the air in the last two years, they have always exceeded my expectations. They truly represent amateur communication equipment at its finest."

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The Operating Position at W6UOU showing Ted Henry and his Collins 75A-4 and KWS-1.

Collins KWS-1 SSB Transmitter,
Net Price $2,095.00
Collins 75A-4 SSB Receiver,
Net Price.....$695.00
Collins KWM-1 SSB Mobile Transceiver,
Net Price.....$770.00

HENRY HAS ALL Collins SSB EQUIPMENT *for immediate delivery*

Top trades . . . 90 days open account or only 10% down—up to 20 months . . . Personal Service . . . Fast Delivery. Henry has ALL the New Equipment.

Write, wire, phone or visit either store today.

We are proud to have helped hundreds of fellow amateurs enjoy the thrill of operating these superb Collins transmitters and receivers. Our liberal trade policy and easy terms puts them within YOUR reach.

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Butler, Mo.

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Henry Radio Stores

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11240 West Olympic Blvd Los Angeles 64

"World's Largest Distributors of Short Wave Receivers."

For further information, check number 73 on page 206.

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K2EPG STAN
K2IQX JACK
W2IZF BILL
K2OKV PETE
W2UKU TONY
W2YK BILL

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PASSAIC — PR 9-4962
RIDGEFIELD — WH 3-0510
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GONSET
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NATIONAL
KTV TOWERS
ETC.

For further information, check number 74 on page 206.

the Collins 75A-4

Designed expressly for Operation on the 7 HF Amateur bands

This outstanding SSB receiver features AVC on SSB and CW, separate detectors for AM and SSB, passband tuning, rejection tuning, Gear Reduction Tuning Knob, superior selectivity and many other time-proven Collins features. Net Price $695.00

Complete line of Collins equipment and accessories.

RADIO EQUIPMENT COMPANY, INC.

821 West 21st Street
Norfolk 10, Virginia

For further information, check number 75 on page 206.

Contest Calendar

Frank Anzalone, W1WY
14 Sherwood Road,
Stamford, Conn.

Oct. 1–Dec. 31	OV Munich
Nov. 6–Nov. 7	YLRL Phone
Nov. 13–Nov. 14	YLRL CW
November 9–11	ARRL SS
November 16-17	ARRL SS
November 23–24	RSGB 21/28 Phone
Nov. 30–Dec.2	CQ WW DX CW
December 8	CCRC DX CW
January 3–5	DARC WAEDC CW
January 18–19	CQ 11 Meter
April 4–6	DARC WAEDC Phone

OV Munich
This one is already under way but there is still plenty of time left to participate. See last month's issue for all details.

YLRL Party
The YLs will hold their annual party beginning at 17:00 GMT Nov. 6th and ending at 05:00 GMT on Nov. 8th for the Phone group. The brass pounders will start at 17:00 GMT Nov. 13th and end at 05:00 GMT Nov. 15th.

ARRL SS
Strictly a local affair designed for you "speed merchants."

RSGB 21/28 Phone
For phone men only. Rules and scoring system in Oct. issue.

CQ WW DX
By the time you receive this issue the Phone Section should be about ready to start or past history. We hope the good conditions predicted by W3ASK were not loused up by a sudden electronic storm like last year.

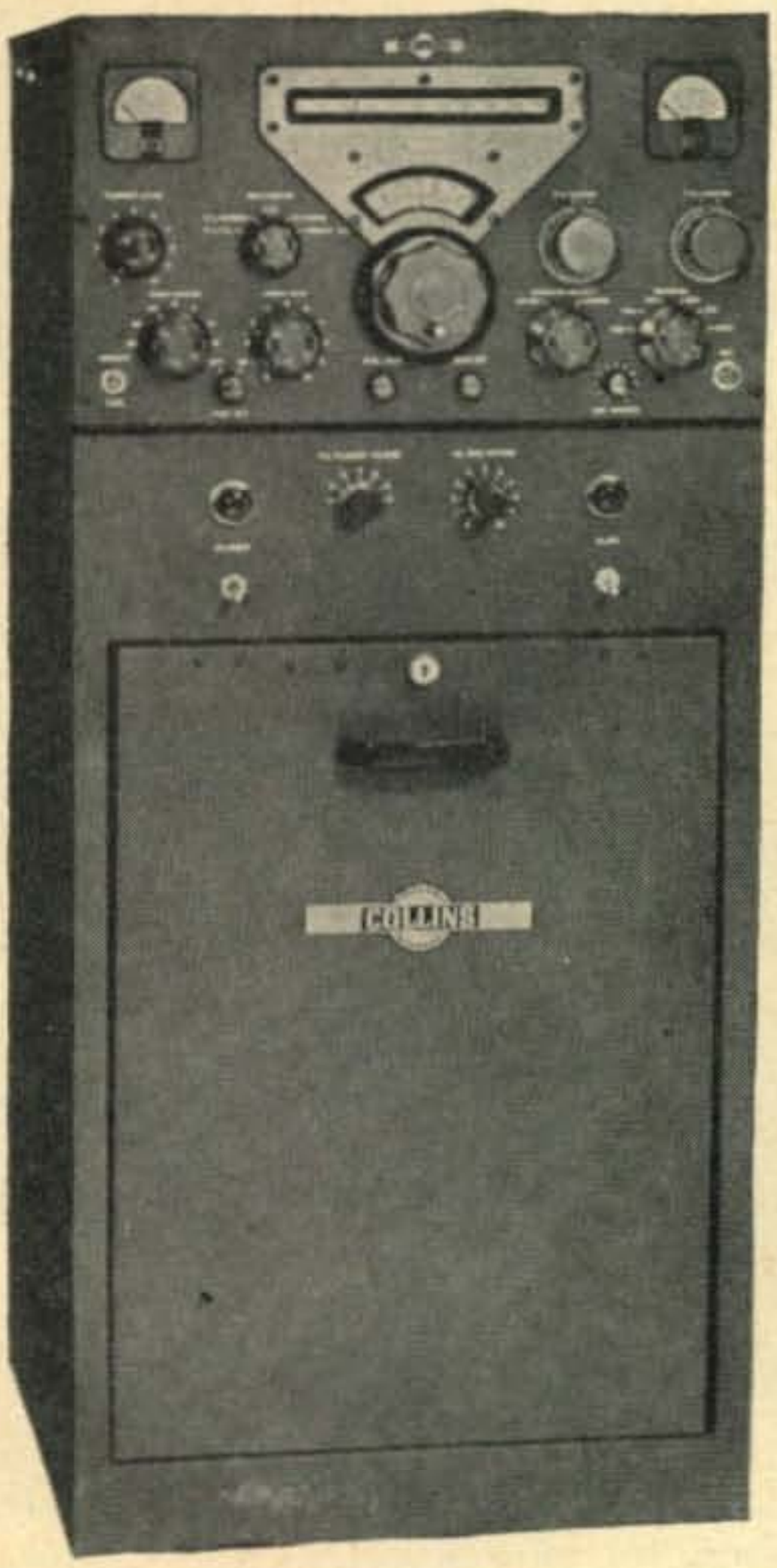
If you haven't started making plans for the CW portion, you had better get busy. Even if you are not going for an award winning score you can always pick up some new countries.

For those who still need Aaland Is., look for OH2XK who will be signing OHØ on all bands during the CW portion. Nick will also be on phone beginning about Nov. 24th to give the phone men a break.

HB9RS will again be on from Liechtenstein during the Phone Section, signing HB1RS/FL. Max QSLs 100 per cent so I hope you fellows got him during the phone contest.

Burghardt Radio has 'em in stock

Collins SSP equipment for immediate delivery



KWS-1 TRANSMITTER

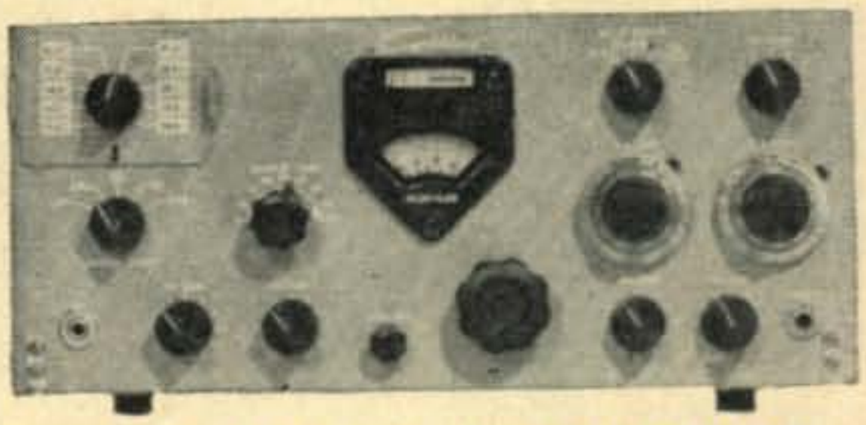
Finest kilowatt in Amateur SSB history. Efficiently compact, with all controls necessary for tuning and operating in one receiver-size, table-top cabinet. Dual conversion makes the KWS-1 as stable on 10 meters as it is on 80. PA network for continuous tuning from 3.5 to 30 mc with constant L/C ratio over entire range. 1 kc dial division on all bands — 80 through 10 meters. Special sideband generation utilizing Mechanical Filters provide 60 db sideband suppression. Effective spurious suppression. These and many other features give you unmatched performance, accuracy and stability in SSB, AM and CW operation.

KWS-1 Net Price $2,095.00

75A-4 RECEIVER

Designed for best SSB reception without sacrificing top efficiency in AM and CW. The 75A-4 features passband tuning, AVC on SSB, bridged T rejection notch filter, built-in crystal calibrator circuit, separate detectors for AM and SSB, and provision for 3 Mechanical Filters together with time-proven features such as excellent image rejection, and an accurate linear dial with calibration of 1 kc per division on all bands.

75A-4 Net Price, complete with Gear Reduction Tuning Knob, 3.1 kc Mechanical Filter, and tubes $695.00



KWM-1 MOBILE TRANSCEIVER

First SSB Mobile Transceiver ever offered. 14-30 mc. 175 watt PEP input. Use for mobile or fixed station without modification. Frequency stability comparable to KWS-1 and 75A-4. Break-in- CW using VOX circuits — side tone CW monitor. Self adjusting ALC. Mechanical Filter sideband generation. Complete TVI filtering. Pi-L output network. 6¼" H x 14" W x 10" D. Available in limited quantity.

KWM-1 Mobile Transceiver, Net Price $770.00

Go SSB with Collins gear now—pay later. Use our time payment plan with 24 months to pay. Trade-in allowances.

Burghardt RADIO SUPPLY

Box H-746
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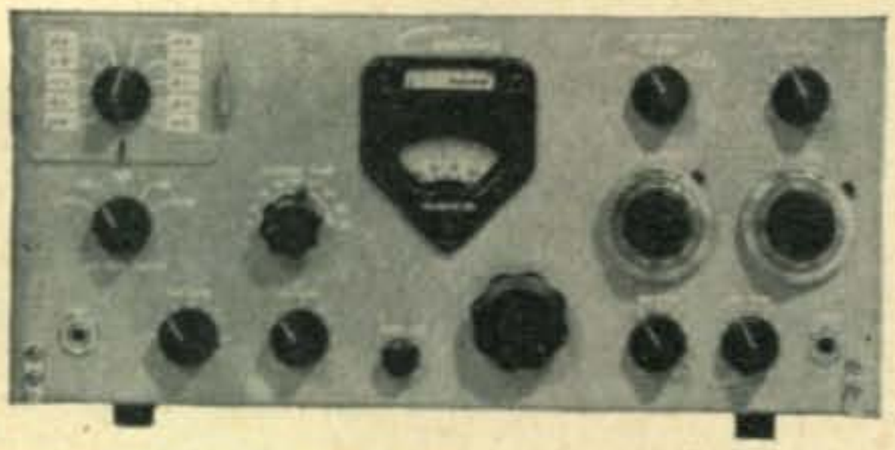
South Dakota

For further information, check number 76 on page 206.

the Collins KWM-1

SSB Mobile Transceiver



FIRST Mobile SSB Transceiver — 175 watts PEP input, 14-30 mc. Excellent frequency stability. Use as mobile or fixed station without modification. Break-in CW using VOX circuits, side tone for monitoring CW. Ten 100 kc. bands available anywhere in the 14-30 mc range. 6¼" H x 14" W x 10" D. Net price $770.00

Write or see us about trade-ins, time payment terms.

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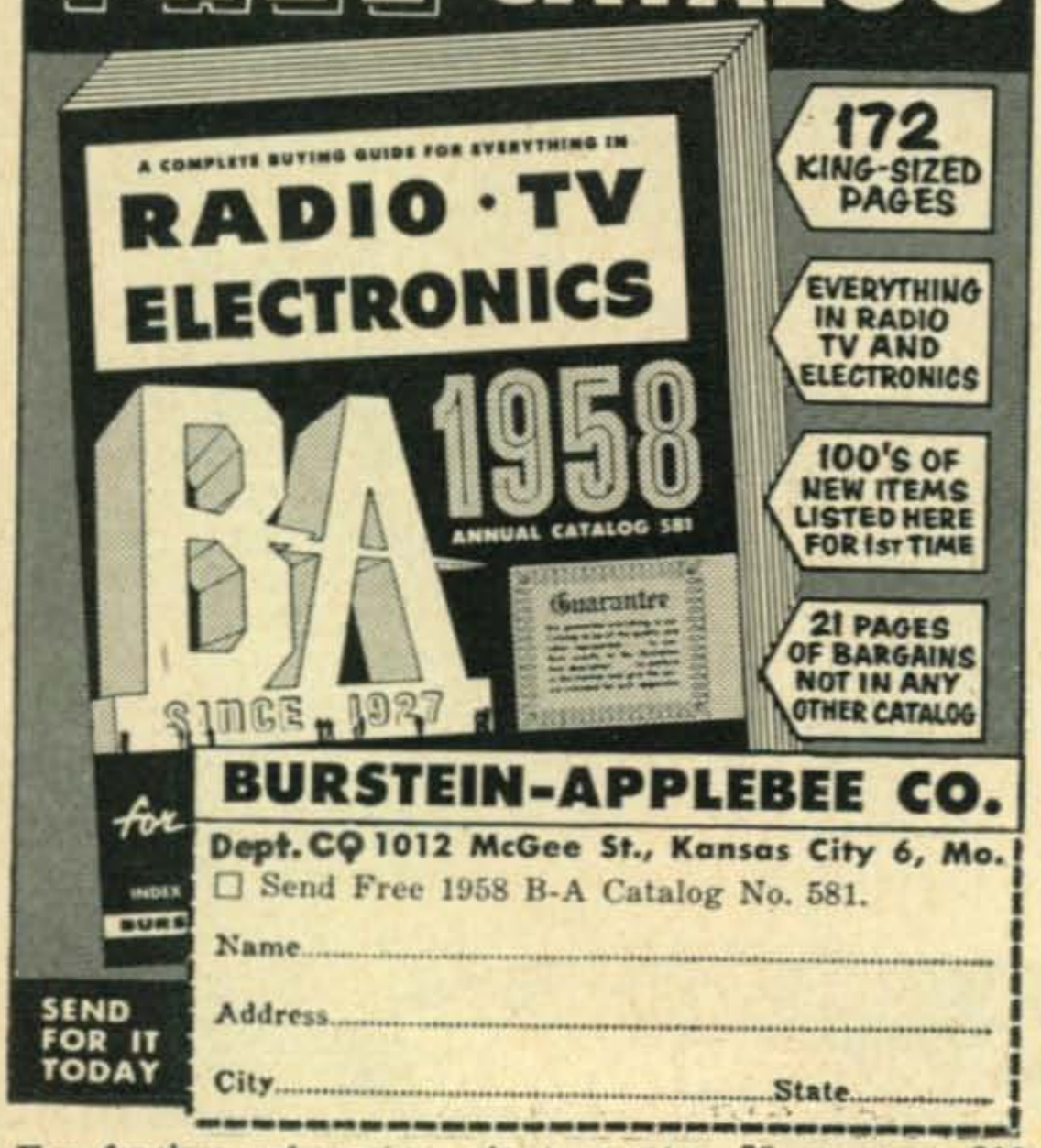

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Name.....

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City.....State.....

SEND FOR IT TODAY

For further infomation, check number 78 on page 206.

Altho the news has been widely circulated via the grapevine, of the anticipated operation from a small European country that heretofore has not been conquered by ham radio, this DX expedition is not yet official at this writing, so therefore must remain nameless for the time being. If it does come off, however, it will take place during the CW Section of the contest, and it will be headed by one of the country's top contest men. All electric utility companies will be warned in advance so that preparations can be made to handle the unprecedented power load when he opens up.

And for the oversea contingent, the gang at WØLNI will set-up in South Dakota to make that hard to get state available for those needing it for WAS.

George Jacobs will again have a special propagation report for the contest period so be sure to read his column.

CCRC DX CW

This is a new one organized by the Czechoslovakian Central Radio Club on the occasion of its 5th anniversary.

Time

Dec. 8th—00:00 GMT to 12:00 GMT.

Rules

1. CW only. All bands 3.5 thru 28 mcs.
2. This is an international contest, therefore participating stations should try to contact sations in other foreign countries as well as Czechoslovakia.
3. The usual 6 digit serial number will be exchanged, RST report plus a progressive number, starting with 001, for each contact.
4. Three points for each completed QSO. However contacts with OK stations will earn double value of points.
5. The multiplier is determined by the number of continents worked on each band. Therefore the maximum attainable multiplier is 30.
6. Two classifications: single operator and multi operator. Entries should also state if log is to be judged for one band or all bands. If more than one band is used state which band is to be judged, if you wish single band credit.
7. Use a separate log for each band and enter the multiplier only the first time it is contacted on each band. (Same as our W.W. DX.)
8. Certificates to the top station in each country plus a special certificate for anyone working 100 different OK stations. Another certificate will also be awarded to stations working all continents on a single band.
9. Sign the usual declaration and send your log to the Czechoslovak Central Radio Club, Box 69, Prague, before Jan. 15, 1958.

CQ 11 Meter

The 11 meter party held last June proved so

[*Continued on page 154*]

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EXCLUSIVELY FOR HAMS And Designed by Hams

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Dual Conversion
Calibrated tuning dial
Two-speed tuning 75-1
Maximum performance on ssb, cw, and phone Covers 1.8 Mc to 29.7 Mc

$249

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GO MOBILE WITH ELMAC!

Pick up your AF-67—jump into your car —take her with you. **$177**

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UNIVERSAL POWER SUPPLY PS-2V 6-12-115 volt **$49.50**

PMR RCVR $159

6-12V power sup. $34

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for fast service
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HAMMARLUND HQ150

Xtal filter, Q-multiplier, xtal calibrator w/check points every 100 kcs. Speaker extra. **$294**

HAMMARLUND HQ110

Newest in the line — dual conversion, ssb, Q-multiplier, xtal calibrator frequency range 6 meters thru 160 meters!

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Spkr. extra

Again in Stock. The famous **PANDA BEAM** for 10-15-20 meters **$99.50**

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WALT WHITMAN HOTEL
Jr. Ballroom

TRENTON
WED., NOV. 6th
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STACY TRENT HOTEL
Terrace Room

WILMINGTON
THURS., NOV. 7th
(7 to 11 P.M.)
KENT MANOR INN
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NORRISTOWN
FRI., NOV. 8th
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VALLEY FORGE HOTEL
Ballroom

PHILA.
TUES., NOV. 12th
(7 to 11 P.M.)
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W3DEN—ED HALLMAN
W3FLP—RALPH GARRICK
W3WW—PAUL KELLER
W3YLG—JOE GRIFFITH
W3MYR—CLIFF GILBERT
W3EKO—GENE ADAMS
K2AAR—DICK AMRICH
W3DQZ—RAY DeCOURCELLI
W2TXP—GEORGE CUTLER
K2HLN—LOU RADIO
W3UMV—CHARLIE REED

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RTTY [from page 141]

presented with a working Model 14 Typing Reperforator, a tape head, a dual-faceplate distributor, and an AC-governed motor for his Model 26.

Special thanks go to Bob Weitbrecht, W9TCJ, for his fine photos that appear here. The hard-working RTTY Committee that made this year's RTTY Meeting such a success consisted of W9SPT, W9GRW, WØBP, W9JBT, W9OCV, W9TCJ and WN9CNY.

73, Byron, W2JTP

K6CHR having an "eye to eye" QSO on the W9TCJ 2-station conference hookup.

Bruce Rowlings, ZL1WB, gives the low-down on the down under.

Nebraska Hamfest

The Pioneer Radio Club of Fremont, Nebraska, is sponsoring a Hamfest to be held at the Hotel Pathfinder on Sunday, November 3, 1957. It will be an all day affair and will wind up with a banquet in the evening. XYL's are invited too. More Info? Write Tom Morris, WØVUO, 134 East 4th Street, Fremont, Nebraska.

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For further information, check number 81 on page 206.

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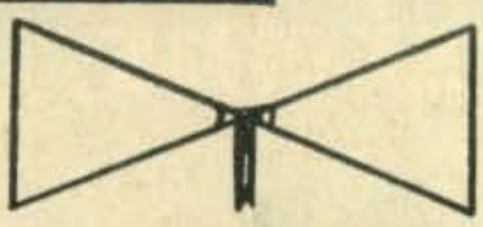
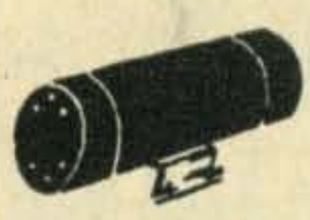
"Wonder Bar" 10 Meter Antenna

As featured in Nov. 1956 QST. Complete with B&W 3013 Miniductor. Only 8 feet long for 10 meters. **Net.....$6.95**



6 Volt Dynamotor



Rated output: 425 V. DC at 375 ma. High efficiency, compact. 4" diameter, 7½" long. Shpg. wt. 13 lbs. Worth 2 to 3 times this low price..... **$12.95**

52 Ohm Coax

100-ft. roll RG-8U, 52 ohm coax. Complete with two PL-259 connectors.

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For further information, check number 82 on page 206.

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37-10 33rd Street, Long Island City, N. Y.

YL Ham [from page 31]

been sullied by the entrance of a Ham of dubious gender.

There are other little things I could mention too. Like when Field Day rolls around and you happen to belong to a radio club, you are automatically assigned to do the cooking and just because you happen to be a YL. Another thing I've noticed is that OM's don't pay much attention to the signal reports, etc., from female Ops. I suppose this, too, is just because they are coming from a YL and are probably thought to be not too valid. The kind of reports OM's are most interested in are things like your age, marital status, hair color and how much you weigh sopping wet.

I don't mean to be criticizing the OM's. Not in the least. I'm frequently overwhelmed by their generosity and earnest desire to be helpful. All in all, I think they're pretty wonderful. One time I was in Henry's buying some fuses and the clerk and I were talking and he winked at me and asked me, 'what was I going to do with all those great big handsome men I was going to meet on the air?' "Wolves, you mean," snorted a surly looking character standing nearby. (I've since found out that HE isn't a Ham and I think that's significant.) Now, he's completely wrong. Hams are the nicest fellows a girl could ever meet. He was probably just jealous because of all the things OM's can do. Like I never cease to marvel at the way they can concentrate. Once two of them came over to check my transmitter for me and they became so absorbed they hardly even knew I was there. As a matter of fact, my girl-friend and I went to the beach and were gone three whole hours. They wouldn't even have known we were gone except that when we came back they were looking for me to tell me there wasn't any more beer in the refrigerator. And they're not wolves either. If they say they want to come over and check your grid current, which could certainly be said with a leer, that's exactly what they do if they come over. Just what they say they're going to do. One doesn't have to have been a track star in High School when one goes out with a Ham. I don't mean to imply that they aren't romantic though. Why, not very long ago one told me fervently that next to a KW rig I was a Ham's dream.

And on my last birthday a Ham friend of mine gave me a beautiful package containing TWO 6146's. I don't know of any other girl who gets 6146's for her birthday. I think it shows a lot of originality. Don't you? Anyone can get flowers or candy or perfume.

I think the sweetest thing an OM ever did though was one Sunday last May. The desert wildflowers were in bloom and it was a lovely Spring day, ideal for a picnic. We drove to a secluded place called Red Rock Canyon and there wasn't a soul around for at least thirty

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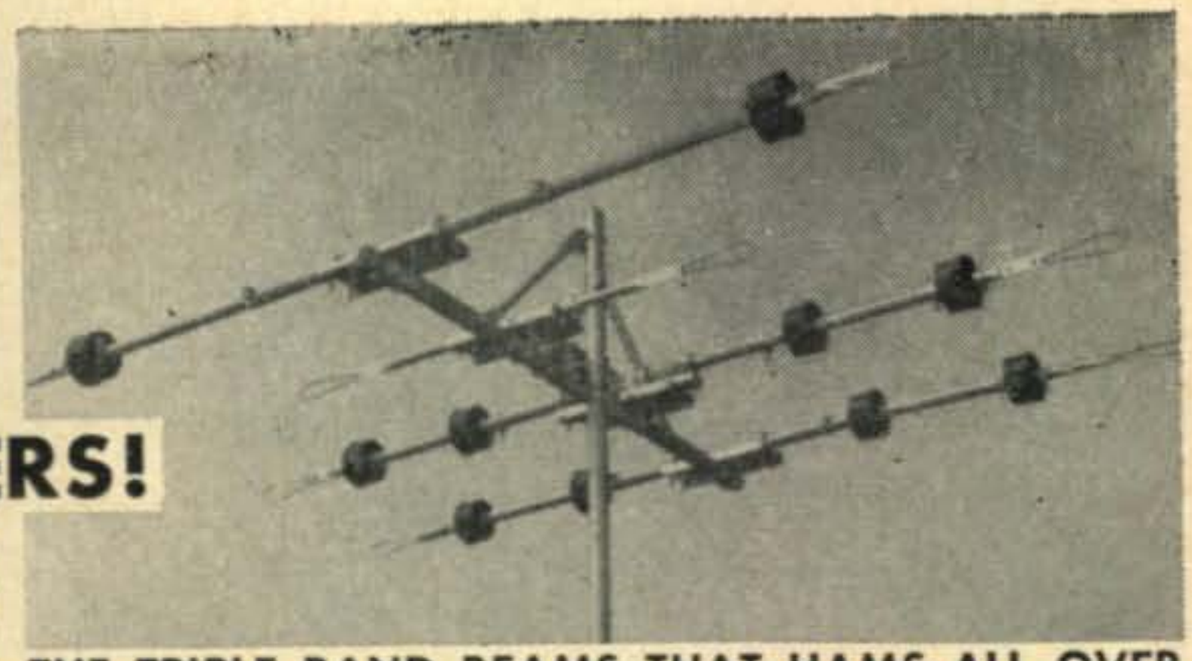
GLOBE SPANNERS!



Now, new improved weatherproofed and tunable "Insu-Traps" make them even better! Pre-tuned by the factory for positive performance, but color code calibrated for ease in peaking from phone to CW, or to any favored part of the bands. Rated at full KW. Perfect match (lower than 1.65 to 1 SWR) to a single 52 ohm co-ax line on all three bands—10, 15, and 20. Ruggedly constructed, for years of dependable performance.

THE TRIPLE BAND BEAMS THAT HAMS ALL OVER THE WORLD HAVE BEEN RAVING ABOUT!

ONE ELEMENT

Single three-band dipole, may be rotated or fixed in favored position. 28 feet long, weighs 10 lbs.

Model 152-T1, $39.95

TWO ELEMENT

A space saver that can give you a healthy 5.8 db gain in signals transmitted and received! Boom only 6 feet long. Wt. 36 lbs.

Model 152-T2, $69.50

THREE ELEMENT

The favorite! Now with separate 10 meter reflector. Greatest power gain per Dollar, 8 db on all bands! 18 foot boom, 29 foot element. Weighs 58 lbs. **Model 152-T3, $99.75**

(Additional 10 meter director element, for even more boost in power. **Model AD-1, $14.95**)

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One pair of Insu-Traps in a 107 ft wire, center-fed with co-ax, gives a high efficiency antenna, with automatic easy loading on 10, 15, 20, 40, and 80. Full KW.
Pair, with complete instructions and wire clamps.
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NEW! SELF-SUPPORTING MULTI-BAND VERTICALS

Only 21 feet high, but capacity top-hat and 3 Insu-Traps give low SWR match to 52 ohm co-ax, on 10, 15, 20, and 40 meter band. Use with radials or on ground. Complete with new, improved fibre glass nylon base, hardware, and complete instructions. **Model 14-AV — $27.95**

Combination Radial and guy wire mounting kit. Complete with 5 ft mast and hardware.
Model 14-RMK — $9.95

NEW! FULLY AUTOMATIC, 10 thru 80 without taps or switching! 38 feet high. With insulated mounting for side of house, tower, or pole. **Model 18-AV — $69.50**

NEW! Three Bander for 10, 15, and 20. Only 20 feet high. With new self-supporting base insulator assembly. **Model 12-AV — $19.95**

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NEW GROUND PLANE for 2 and 6 meters.
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ROTO-BRAKE

The amazingly simple but effective IRON FIST that holds your beam mast from turning in even the highest winds (up to 80 MPH!), protecting the TV type rotator and your beams from damage. Also provides thrust and radial bearing support for heavy beams. Just 2 wires to rotator control box terminals gives it automatic single control of the roto-brake. With brackets for mounting inside 10 to 18 inch dia. towers.
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Recommended TV type rotator.
CDR Model AR-22, $31.17

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Hurry on in! With the new highways, it really isn't much of a drive, from even Maine, Ohio, or Virginia! Easy parking. Bring along your old gear, for my tip-top allowance. I guarantee you'll go home delighted.

73, Bil Harrison, W2AVA

From South and West: Thru New Jersey, leave Holland Tunnel in "Downtown" exit lane, continue straight down for 12 blocks.

From North: Thruway exit 7, Saw Mill River Parkway, (or George Washington Bridge), down Henry Hudson Parkway and West Side Highway. Exit at Chambers St., left on Chambers 3 blocks to West Broadway, right 4 blocks.

From New England: Merritt Parkway, to West Side New York via Henry Hudson and West Side Highways. (See "From North")

From Long Island: Via Brooklyn-Battery Tunnel, right on West St. 9 blocks to Vesey St., right 2 blocks to Greenwich St., left ½ block.

Via Tri-Boro, Queensboro, or Midtown Tunnel: East River (F.D.R.) Drive downtown, and around thru underpass tunnel to Brooklyn Tunnel entrance, but continue straight up West St. 9 blocks to Vesey St., right 2 blocks to Greenwich St., left ½ block.

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IRT, Lexington Ave. Express to Fulton Street station, up Broadway to Barclay St., left 2 blocks.

IRT, 7th Ave. Express to Chambers Street station, down West Broadway 4 blocks.

IND: Take A, AA, CC, or D train to Hudson Terminal (Chambers St.), one block west on Barclay St.

BMT 4th Ave. line to City Hall Station, walk two blocks west on Barclay St.

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Penn Station: Take IRT Subway Express downtown 2 stops to Chambers St.

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Hudson Terminal: Fulton St. exit, left 1 block to Greenwich St., right 1½ blocks.

Barclay St. Ferry: 2 blocks east to Greenwich St.

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miles. After we had eaten the fried chicken etc., I had prepared for our lunch he spent the whole afternoon on the mobile rig, (he was trying to get his WAS on 20 'fone, you see.) The sun was just about to set when he disappeared behind a cliff and told me to wait, that he had a surprise for me. He was gone an awfully long time but you can't imagine how touched I was when he finally came, shyly took me by the hand and showed me what he had been doing. There, side by side, were our call letters, carved on a rock.

Actually, I think it is the XYL's who need a bit of constructive criticism. I know one OM whose XYL gets real mad at him if she hears him talking to a YL on the air. And there's another one who pulls the main switch if her OM happens to get into a QSO with a YL.

There are a couple of things I wish they wouldn't do. Like if I see a call letter license plate while I'm driving through the L.A. smog, I'll congenially toot a CQ on my horn. The Ham in question will usually look at my plates, pull up along side and say, "That the OM's call?" Now it seems to me that he would realize that I gave out a CQ instead of a HI because I'm a Ham in my own right. I think most of the OM's on the air still haven't gotten used to women having tickets. It's probably a lot like when women first got the vote, I guess.

Another thing, I wish when I'm on the air OM's answering my CQ wouldn't always think I'm a boy. I'll tell them my handle is Myrlin and invariably they'll come back with, "FB Melvin." Then if I happen to get too near someone's frequency during a QSO, I'll hear one OM tell the other, "There's some kid calling CQ on the frequency."

Oh, I almost forgot to tell you how I solved my antenna problem. I moved. A girl friend of mine and I now share a house in Beverly Glen. I'm in another canyon but this one has very small hills. A Ham pal of mine put up a 260' end-fed long wire for me. It goes up the side of a hill in back of the house and is attached to a 12' mast on top of the garage. He says it is clear in all directions too. At least I don't have to worry about anyone cutting this one down. The hill is full of poison oak and poison ivy, making it just about as inaccessible as an antenna could possibly be. I did have some TVI for a while though. My girl friend used to like TV but I took care of that. No, I didn't remove a tube from the set when she wasn't looking and no, I didn't install a hi-pass filter. I've got her studying the code. Naturally. And twice a month she faithfully attends the Palisades Amateur Radio Club, of which I'm a member and the newly elected Secretary.

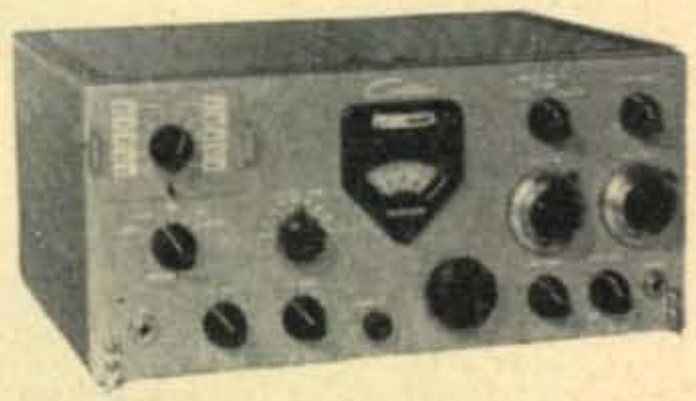
So it looks like K6RFX can now get down to hamming in earnest. You can hear me most any night and week-ends on 40, 20, 15 or 10. ■

don't settle for less than *Collins* from ACK RADIO SUPPLY CO.

CALL "ACK" W4ECI

KWS-1

75A-4



KWM-1

KWS-1

POWER AMPLIFIER INPUT — 1 kw peak envelope power SSB, 1 kw CW operation. Equivalent to 1 kw on AM when using narrow bandwidth receiver.
R-F OUTPUT IMPEDANCE — 52 ohms.
FREQUENCY BANDS — 80, 40, 20, 15, 11, 10 meters.
EMISSION — SSB, AM carrier plus one sideband, CW.
HARMONIC AND SPURIOUS RADIATION — (Other than 3rd order distortion products.) Intra-channel radiation is at least 50 db down. All spurious radiation at least 40 db down at output of exciter. Second harmonic at least 40 db down; all other harmonics at least 60 db down.
DISTORTION — SSB, 3rd order products approximately 35 db down at 1 kw PEP.
FREQUENCY STABILITY — After 15 minutes warmup, within 300 cps of starting frequency. Dial accuracy: 350 cps after calibration.
AUDIO CHARACTERISTICS — Response: ±3 db, 200 to 3,000 cps. Noise and hum: 40 db or more below reference output level. Input: .01 volts for rated power output.
MICROPHONE INPUT — Will match high impedance dynamic or crystal.
WEIGHT — 210 pounds.
SIZE — (Both Units) — 40½" high, 17¼" wide, 15½" deep.
RACK MOUNTING — Angle brackets kits available for RF Unit and power supply.
Net Price ---------- $2,095.00

75A-4

FREQUENCY BANDS — 160, 80, 40, 20, 15, 11, 10 meters.
SIZE — 10½" high, 17¼" wide, 15½" deep.
WEIGHT — 35 pounds.
RACK MOUNTING — Angle mounting kit available.
NUMBER OF TUBES — 22, including rectifiers.
SENSITIVITY — 1.0 microvolt for 6 db signal-to-noise ratio with 3 kc bandwidth.
AVC CHARACTERISTICS — Audio rise less than 3 db for inputs of 5 to 200,000 uv.
IMAGE AND IF REJECTION — Image ratio at center of each band 50 db or better. IF rejection at center of each band 70 db or better.
AUDIO CHARACTERISTICS — Output — .75 watts with a 3.0 uv signal, 30% modulated. Output impedance — 500 ohms, 4 ohms. Response of audio circuits — ±3 db 100 cps to 5,000 cps. Distortion — Less than 10%.
MUTING — Provisions for muting the Receiver during key-down operation are provided. A muting voltage of +20 volts must be supplied by transmitter.
FREQUENCY STABILITY (at 14 mc) — Temperature — Less than 1200 cycles drift from 0 to ±60° C. Warmup drift — Less than 300 cycles after 15 minutes operation. Line voltage — Less than 100 cycles for ±10% change. Dial acuracy — 350 cycles after calibration.
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Use it for mobile. Use it for fixed station. No modification necessary in this 14-30 mc 175 watt PEP input transceiver. It's new, revolutionary, and we have it for immediate delivery!

Utilization of common components in both transmitting and receiving functions results in a saving of both space and cost and, in the case of frequency-determining components, assures exact coincidence of transmitted and received signals. Frequency stability and readability is comparable to that of the KWS-1/75A-4. The panel meter serves as an S-meter during receive and multimeter during transmit. Break-in CW using VOX circuits is built-in, as is a side tone for monitoring CW. Ten 100 kc bands are available anywhere in the 14-30 mc range. Size: 6¼" H x 14" W x 10" D.

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IN LOTS OF 3 ..... $3.50 ea.

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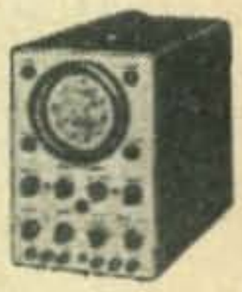

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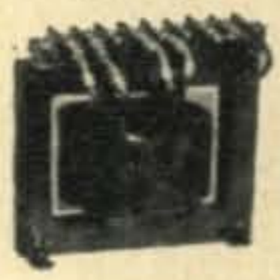

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For further infomation, check number 86 on page 206.

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Letters [*from page 20*]

stations that can be heard, as stated by writer Stanbury.

Like Stanbury, I also have scads of QSL's from the numerous and varied stations which can be monitored at all hours of the day and night on these frequencies. Luckily, being able to copy the CW boys has increased my QSLing potentialities.

Probably because of lack of space, a number of other good DX frequencies were not covered in Stanbury's article. I have always found 2670 kc, which is a USCG calling frequency, most interesting; and 2638 and 2738 kc/s, intership frequencies, always provide a behind the scenes look at the harbor transportation and commercial fishing activities in any area.

Is there any chance for the many "Forgotten Band" enthusiasts throughout the world to be treated to a monthly section of CQ devoted to this adventuresome hobby?

Tom Kneitel
Rego Park, N.Y.

Boys Scouts

This ham radio demonstration was a feature of the Boy's Life event of the Kansas City, Mo., area council, 45th Annual Boy Scout Round-up, May 3rd and 4th, 1957. Working cw the hams transmitted from opposite ends of the arena of the Municipal auditorium. Shown, extreme left is Brok Self, 4055 McGee, KNØIWI and extreme right, Gerald Schlatter, 800 Huntington Rd., KNØHPR, both of Kansas City, Mo. Both are 15 years old and are members of explorer post 2060 sponsored by Wesport Presbyterian church. KNØHPR is using an RME-45 receiver with a Heathkit DX-35 transmitter. KNØIWI is using an SX-99 receiver with a Heathkit DX-35 transmitter.

Christian Hams

CQ—Editor

Few amateurs know there are several Christian organizations for amateur radio operators among the thousands of amateurs in this country. These organizations are interested in all Christians who are amateur radio operators.

The Christian Radio Amateur Directory is published free by the Moody Bible Institute and contains names and addresses of Christian amateurs in alphabetical order. This directory can be had free by writing Moody Bible Institute Amateur Radio Club, 820 N. LaSalle St., Chicago 10, Ill.

Another organization is the "Hams for Christ", Christian ham organization which is interested in tract work among the hams as well as magazine and other advertising among the hams. Details are free from "Hams for Christ", P O Box 218, Holland, Michigan.

The third Christian ham organization is the Amateur Radio Missionary Service Group. This group is interested in missionary work of all types among the hams with headquarters at the Philadelphia Bible Institute. Details can be had by writing Richard B. Harris, 1014 Chestnut Ave., Laurel Springs, N.J.

73,
Rus Sakkers, W8DED

MISLEADING ADS?

Dear OM:

We have been subscribing to "CQ" long enough (1932) to know that this journal would never allow misleading advertising to appear knowingly within its covers.

We have been in the radio communications business both professionally and hamwise for about 35 years. We are reasonably open-minded about an art that is making tremendous strides with radically new discoveries appearing almost daily.

We do not believe, however, that the basic principles surrounding electro-magnetic propagatios and radiation have changed. We do believe that it is possible to "resonate" almost any likely (and unlikely) configuration of wires, tubing, etc., 27" x 22" x 5" to 7-14 mcs. Such an arrangement would—if "properly" designed have a very high "Q"—would be definitely narrow-banded, have a good high local induction field and a negligible "far-field"!

What are the "unusual gain figures"? As you know "gain" can be represented by zero (or less) db!! Where are the "several DBS we mention"?

Which branch of "armed services"? Signal Corps or Quartermasters section? Who are the "independent labs" mentioned?

Both CQ and "QST" have a reputation to uphold with their readers.

This antenna, if the claims made for it are true, it is truly revolutionary. Will its backers send you a sample with which to conduct on-the-air tests?

H. E. J. Smith, W5DAI
Las Crucus, N.M.

Dear OM:

Your observations are interesting and your argument well put. We do everything we can to protect our readers and have, sob, turned down or discouraged several advertisers and potential advertisers. In fact, I believe that we are now one of the strictest in this respect.

When I first read an announcement about a year ago that such an antenna had been invented my reaction was the same as yours. Sure, you can load up anything. But will it do better than a dipole? Will it act like a beam and have front-to-back and front-to-side ratios? It seemed unlikely. I decided to ignore it and wait until some one sent in some test data and a reasonable explanation of how it worked.

Then, in February, while down in Washington for a dinner, I met Gay Milius, W4NJF, who said he had one of the antennas at home. I asked him to explain how it worked. He said that he didn't have the vaguest notion and he didn't think that the fellow who discovered it did either . . . but that it worked and he could take me home and prove it.

When we got there he fired up the receiver on 75 and rotated the little gadget which he had sticking up in the attic, Zounds! Then he changed to a regular antenna and signals dropped off a bit. It was definitely directional and seemed to be better in its chosen direction than the outside antenna. I was impressed, but still not convinced.

In May, while at the Chicago Parts Show, I ran into Byquist, the inventor of this doohinky. He unfolded the story of how this thing came about and the long series of tests that he had had to go through to prove the thing, since no one with any engineering background believed it could possible work. Each new engineer had to be convinced in turn, with everyone suspecting a gimmick. He promised to provide complete lab data as soon as it was available for publication.

So, as you can see, we still have a lot to learn about this new type antenna. The ads for it have been remarkable for their restraint in claiming db gain, etc. Stan Byquist, has an impressive bunch of DX cards to prove that it puts out and everyone else that I have talked to that has tried it backs him up. He and Mr. Freeman, the manufacturer, promised to send me one of the first production models, so I should be able to give an even more educated evaluation of it before long.

Wayne Green, editor ■

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HAMMARLUND

HQ-100, HQ-110 (NEW), HQ-150, HQ-140XA

COLLINS

KWM-1 (NEW), KWS-1, 75A4

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For further information, check number 88 on page 206.

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- ★ Adequate over-all selectivity with nine miniature tubes including rectifier.
- ★ Has gang-tuned RF amplifier stage for increased sensitivity and image rejection.
- ★ Covers 540 KC to 40 MC in four bands.
- ★ Two IF amplifier stages and two audio stages with tone control.
- ★ Separate antenna trimmer on front panel.
- ★ Separate High Frequency oscillator tube for increased stability. Oscillator is temperature compensated and ventilated for increased stability.
- ★ Separate RF and AF gain controls.
- ★ Series type automatic noise limiter.
- ★ Receives AM, CW and SSB signals. BFO provided for CW and SSB.
- ★ Has "S" meter on front panel for signal strength indication and more accurate tuning.
- ★ Provision for balanced or unbalanced antenna input at 50 to 300 ohms.
- ★ Handsome two-tone gray cabinet.

COVERAGE:

BAND	GENERAL COVERAGE	BANDSPREAD
A	.54-1.6 MC	
B	1.6-4.7 MC	3.5-4.0 MC (80 meters)
C	4.7-15 MC	6.9-7.30 MC (40 meters)
D	14.0-40 MC	14.0-14.35 MC (20 meters)
		20.4-21.5 MC (15 meters)
		27.0-30 MC (10/11 meters)

TUNING SYSTEM: Separate general coverage and bandspread tuning capacitors connected in parallel on all bands. Bandspread, used primarily for tuning the amateur bands, can be used as vernier for general coverage use. Separate antenna trimmer control.

AUDIO SYSTEM: Two-stage audio amplifier with single 6AQ5 output tube provides 1.5 watts at less than 10% distortion. A handsomely styled accessory speaker is available. Phone jack.

SENSITIVITY: Under 2.5 microvolts (10 DB signal/noise ratio).

SELECTIVITY	NORMAL
6 DB	5.2 kc
60 DB	22 kc

CONTROLS: Main tuning; bandspread tuning; antenna trimmer; band selector switch; RF gain control; AC ON/OFF and AF gain control; stand-by-receive switch; noise limiter switch; tone control switch; BFO pitch control; AM/CW switch.

TUBE COMPLEMENT:

RF Amp.	6BA6	2nd IF Amp.	6BA6
Freq. Conv.	6BE6	Det, AVC and ANL	6AL5
HF Osc.	6C4	1st AF and BFO	12AT7
1st IF Amp.	6BA6	AF Output	6AQ5
		Rectifier	5Y3GT

OTHER SPECIFICATIONS:
Antenna Input: 50-300 Ohms, Balanced or unbalanced.
Size: 16-13/16" Wide x 10" High x 10-7/8" Deep.
Finish: Handsome two-tone gray wrinkle finish.
Shipping Weight: Approx. 35 lbs.
Optional Accessories: Matching Speaker.

Only $15.95* down
Up to 20 months to pay at most Receiver Distributors.
*Suggested Price: 159.95**
**Prices slightly higher west of Rockies and outside U. S. A.

For further information, check number 22 on page 206.

NC-188

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For further information, check number 23 on page 206.

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